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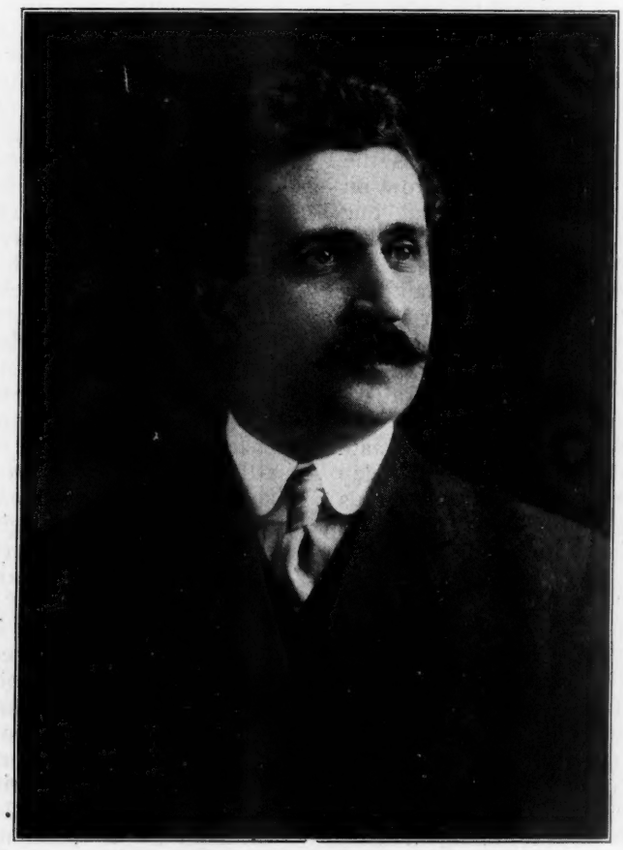
Engineering as Insurance for Future Prosperity

Engineers' Part in the Conservation of Our Resources, in Power Development and Solution of Other Public Problems—Condensed from Address Before Engineers' Club of Philadelphia

By GEORGE OTIS SMITH
Director, United States Geological Survey.

Professor Ely, the economist, has boiled down his discussion of the principles of conservation into half a dozen words that can serve as a rule of action: "Civilization Means Regard for the Future." So when I suggest that engineering is prosperity insurance, my choice of words has not been prompted by the professional character of the audience I face but rather by my idea of what the world needs most.

Fortunately I do not have to define my terms; I have only to set forth the way in which the relation between engineering and prosperity impresses me as paralleling in thought the Ely equation — that civilization means regard for the future. Engineering deals in futures; the engineer ever keeps the factor of safety in mind as he works; he is an insurance agent of the first magnitude, even if he does not talk like one.



George Otis Smith.

The research scientist in his untiring quest for eternal truth compels our admiration, but his hard-won truth must be more than seen of men—use is the better mark of possession. It was a chemist who recently summed up the situation thus: "We have science enough now to provide a beautiful, happy and good world. What shall we do with it?" And my answer tonight is simply: What science has discovered, engineering must apply.

Recently in speaking to representatives of the mining industry, an industry that looms high in the national view as a producer of basic wealth, I said that the dominating note in their policy should be not "wealth" but "welfare." What other word can I bring to you engineers, men who guide the operations and determine the destiny of not alone the mining industry, with all its ramifications in the business world, but of all industry and who also serve the public directly in that large class of activities that we group together under the term public works.

What we seek for our country, then, is welfare rather than wealth—happiness in fact rather than greatness in name. The members of this Engineers' Club do not need to be more than reminded that "the pursuit of happiness" was one of the great self-evident truths set forth in that Declaration of Independence which our fathers assembled here

at Philadelphia gave to the world. Nor are we likely ever to overstress the "general welfare" clause of the Constitution as a guiding purpose in our work, whether we serve the public as engineers in private or corporate employ or as engineers on some public payroll. To strive for well-distributed happiness and to promote the general welfare are aims that belong in the code of the engineer who raises his life work to the level of a contribution to the future.

Prosperity will fail to satisfy us unless it is backed up with guaranties of permanence. Whatever we are to enjoy this year and next we wish our children's children to enjoy in equal if not in larger measure. Can we take out nation-wide insurance to cover this forward-looking wish?

My conviction is that the future of our nation will be largely what engineers make it, and the surplus that can be paid to other generations of Americans will depend upon what you engineers of today write into that endowment policy, which is to be broad enough to cover Philadelphia, Pennsylvania and America.

The nation, like the family, can safeguard its future by thrift. * * * We need now to think in terms of production, simply because without production we cannot consume. Thus the rule of action restates itself; to insure the nation's future prosperity we must insure the nation's industry.

Industry is a reaction into which raw material and energy enter; it is the function of engineering to use both material and energy in the smallest quantities possible; in other words, to make what is used do the most work.

However figured or expressed, the natural wealth of our country is impressively great; we not only know that the United States is the greatest producer of most things that grow on the earth's surface, but we believe that our future crops are to be equally abundant and that America's unmined mineral stores exceed the reserves of most other countries. The plain fact is, and we never hesitate to admit it, our ancestors were wise enough to pick out the best part of the best continent in the world to live on. Yet the possession of greater wealth in natural resources only makes us trustees on a larger scale and places on us the duty to pass this real estate on to our children in first-class condition. Today we possess most of the essential raw materials in abundance; how can we insure our country's industry for the centuries to follow?

Heavy Inroads on Our Natural Resources.

To appreciate the rate at which we increase our annual drafts upon Mother Earth's treasury, a glance at the records for the two chief metals and the two mineral fuels is perhaps enough. Within the last half century the country's output of coal has increased more than 20 fold, iron more than 23 fold, and copper 68 fold, while the flow of petroleum has increased not less than 700 fold. This growth of the mining industry within the life of most of us must open our eyes to the real issue of safeguarding our sources of supply. It is the function of the United States Geological Survey to help to discover new sources of this and that raw material, but it is indeed difficult to foresee what the demand may be even a decade hence.

We are a growing country but our industrial needs increase much faster than our population. Forty years ago when the Geological Survey was created our per capita consumption of crude petroleum was half a barrel a year; now it is three and a half barrels. This rate of increase is nearly twice that of the per capita consumption of coal in the same period. And it cannot too often be repeated that our Federal geologists estimate that while in 100 years we have exhausted less than 1% of our total coal resources, in only 60 years apparently 40% of the available oil in the United States has been brought to the surface and consumed. Is it strange that the hunt for new oil pools engages the attention of the best geological talent and the strongest financial interests?

Although the 99% or so of coal left unmined is a figure which might seem to justify an optimism as to coal that is not warranted as to oil, we may need to think less of the millions of millions of tons of coal which we are told lie awaiting our needs over the length and breadth of our land and to ask for more details as to where this coal is and how much of it remains in the older mining districts.

Must Expect Decreasing Quality and Increasing Cost.

Before you indulge in mental arithmetic in figuring out the life of our coal resources you must set down the broad fact that the best and most accessible coal is mined first. From this premise follows the practical prophecy that with the passing of time in our rapid industrial expansion we may expect for the coal of our future output decreasing quality and increasing cost. It is this aspect of our tomorrow that forces the discussion of the best use of America's coal.

First, we should perhaps try to picture the extent to which we have mined our best coals and also the rate at which we are using up the fuel reserves upon which so many industries are founded. The Pittsburgh coal bed furnishes two excellent examples of the rate of exhaustion. If it is mined at the present rate the exhaustion of this coal bed, the largest in Pennsylvania, must be measured by the span of a single generation; at least we can see the peak of production close at hand, if indeed it has not already been passed, and long before the end of this century coal mining in the Pittsburgh field will be a memory except where a mine here and there is working on outcrop coal or pillars or odds and ends left behind in the big days of the Pittsburgh coal. * * *

The reason for our interest in the past and future of coal is that coal will count for more and more as the controlling factor in America's industrial future. Even now we can take our country's record of the highest per capita coal consumption in the world as the gratifying test of our industrial capacity.

Natural gas is another fuel which must be included in our planning for the future. It is the purest of all fuels—indeed within the area where it can be had it is the ideal fuel. Your state of Pennsylvania is the greatest consumer, though not the greatest producer, as both West Virginia and Oklahoma lead Pennsylvania in the volume of gas flowing from the wells. In the possession of this great resource the United

States stands unique among the nations. As we produce about 95% of the natural gas consumed in the world, we stand as natural monopolists in gas, alongside of Russia in platinum, of Germany in potash, and of Chile in nitrate.

The increase in the utilization of natural gas in this country has been both rapid and steady. Within ten years the output has doubled. * * * We are not warranted in expecting anything in the future but a general decline in the current supply of this fuel. Geology and engineering cannot find for the use of man what no longer exists. Natural gas is a mine that is largely worked out and its future dividends to the nation cannot equal those of the past. Every natural gas company should print "Limited" after its corporate name; its assets cannot be regarded as limitless.

And so we might run through the whole list of essential mineral raw materials as well as the products of the soil. In these, America is rich beyond compare, but the builders and operators of modern industry cannot afford to be spendthrifts. The lessons of the armistice period have increased our appreciation of the factors that insure prosperity. Raw materials and tools are what the war-stricken peoples of Europe are asking for; with these idleness and hunger can be converted into industrial and physical health. Coal and flour are two excellent antidotes for bolshevistic infection.

Conservation of Manpower Aim of Power Development.

Human energy was something that the ancients spent with little regard for present or future happiness. The great monuments of the past—the engineering wonders of the world—commemorated slave labor. Today we regard manpower as something to be conserved, not only because we as practical business men set a higher value upon humanity than even the philosophers of old, but also because we have learned that in much that we try to do manpower is the limiting factor. In these recent days we have learned to estimate the strength of warring nations in terms of manpower, not simply on the firing line in France but far behind that line, across sea and land, deep in the copper mines of Montana and Arizona or on the broad wheat fields of the Dakotas and Canada. Everywhere a man saved from unessential work was one more manpower added to the strength of the nation.

To lighten the load of labor is the real purpose in planning for power. In the evolution of industry animal-generated power was first brought to the aid of man, then wind and running water were harnessed, next fuels, through the agency of steam, made possible the modern industry system, and now electricity has been made a servant of man that promises to lift the burden of toil so that human energy can be put to the highest tasks.

We know too little of the country's present power requirements. Forty million horsepower is a conservative estimate of the total power now developed in the United States, 77% of which is steam and 19% water, the remaining 4% representing power generated by internal-combustion engines. These figures do not include private plants or marine engines, locomotives, or automobiles. The public-service stations are to be credited with half this power, and the percentage of hydro-power in such plants is 29, as contrasted with 9% for manufacturing plants; indeed, the returns available for the earlier months of 1919 indicate that fully 40% of the output of electricity by public utility plants came from hydro-power. To this extent, then, our water power is serving our present needs.

The official estimates of the potential water power in the United States when figured on an 80% efficiency indicate in round numbers a minimum of 30,000,000 hp. and a maximum of 60,000,000 hp. The water power now utilized, however, is less than one-third of the minimum potential power. Or, taking a world view of the water-power situation, we find our country standing third in potential power resources, with about 7% of the world supply, but first in rank, as determined by developed power, with 45% of the world's total. Canada, France and Norway stand next in order as to power developed but the total of all three is only half the water we use.

These are the basic facts that suggest what the future can hold for us. Unfortunately, there remains a fact of geographic distribution that affects future utilization; as pointed out recently by W. B. Heroy, 70% of the available water power is west of the Mississippi, whereas 70% of the water power now installed is east of the Mississippi. With the largest power market and the largest power supply so separated, fuel power must continue to carry its part of the load.

Super-Power Plan Is Answer to Best Use of Coal.

The super-power plan that is now being advocated for the great industrial region of the East seems a direct answer to the appeal for the best use of America's coal. In its broad outlines, this plan, for which a Federal investigation is being asked of Congress, is the linking up of high-power, high-economy generating stations with a super-power transmission line—a veritable stream of power from which will flow the current wherever it is needed for transportation, industry, or home use. You engineers do not need to be told by me the possibilities of saving through higher load-factor, lower coal consumption, and greater certainty of continuous service. How the engineering details of so great a plan are to be worked out is a story for future telling; but we can confidently expect that this interstate system, so essential to the whole nation in helping us to meet international competition effectively, will be thoroughly democratic in spirit and will be so planned as best to serve the greatest number of citizens.

Conservation, whether of material or of energy, is engineering and the policy which a few years ago began to attract public attention is really as old as engineering. The truth is that we needed thrift on a national scale before we began to realize it and conservation or national thrift therefore became a popular issue. The task is growing larger and more critical, however, as the years pass, and it places a large civic duty upon the engineer. In his role of insurance agent the engineer has not only to plan but to execute, yet in putting his plans into effect he

must depend upon popular support. The public must be educated in its use of resources and the engineer must therefore also function as a teacher. * * * It would be well for America if some great engineer could go up and down this country and convince our citizens in their own language of the economic needs of an industry which will produce more than it consumes, of the advantage of large-unit operation, of the value to the country of an improved load-factor, and of the facts that coal and iron resources represent a nation's expendable assets and that the center of the earth is not an inexhaustible reservoir of oil and gas. These are self-evident truths but the American people are not yet familiar enough with them—they need to be shown.

Public Service Must Be Ideal for Power System.

In setting up a practical ideal for a power system, the two words "public service" are enough. Service to the public is the power plant's reason for being, and the quality of that service should measure the corporation's standing with the customer and indeed in the community and in the Nation. I fear lest for political effect too much stress is often laid on price; of course, both economist and engineer must give full attention to the question of cost, as well as to the possible profit in the business, but another element in service is perhaps even more important, and that is reliability. I notice that Robert Treat in a recent technical paper puts foremost among the aims of the electrical engineer who is planning a large electrical layout reliability of supply and continuity of service: the flow of energy must be uninterrupted.

The power company, then, deals in service. A recent article in one of the engineering journals in describing a great interstate power system classified the causes of the interruptions of service on its lines so far as they could be determined. Lightning and sleet and high winds, which are beyond the control of either company or customers, together caused 33% of the breakdowns, but failure of the customers' apparatus and carelessness in the customers' operation caused 35% of the interruption in service, while the corresponding figure for company failure and carelessness was less than 10%. * * *

Engineer's Opportunity in Solving Public Questions.

No type of citizen, then, is better fitted to tackle the civic problems of today than the engineer. The large questions before the people are economic questions, and engineering is mainly science applied to life in an economic way; the engineer in his experience as well as in his training has studied problems in economics, whether his textbook bore that title or not or whether his design or his contract was so labeled or not. The constructive issues that are before the American people this year and that promise to remain before our legislative bodies for several years are all in some degree engineering issues and in a large degree they represent on a national scale problems closely akin to those of everyday work that you engineers have in hand on a unit scale. And your strength as citizens comes from the fact that you know that the eternal laws and principles of matter and energy that you must heed in your own working plans must be respected in the Nation's policies; no matter how humanistic or idealistic or altruistic such policies may be in motive, they will not hold water if they have holes in them.

The transportation problem now before Congress, with March 1 as the date of delivery for the legislative remedy; the many questions relating to the production and distribution of the commodities that are essential to life and comfort; the working out of the equities of the partnership between labor and capital and the public —these are all practical economic issues to the consideration of which the engineer can bring an analytical mind and a large store of facts.

These public questions are more or less interlocking; our coal problem is hitched up with the railroad problem and both are related to the super-power plan, while the power program in turn contributes to the labor question, and the underlying ideal of prosperity distribution is but another name for profit sharing, which involves accounting in terms of equities. Some of the outstanding elements in these national issues may be stated, however, even if a logical analysis of each question is not made.

The coal industry furnishes perhaps the best example of how the operators, the mine workers and the consumers are all tied together in actual interest. The curve of weekly coal production tells the story of highly irregular operation, and idle plants and idle men are expensive taxes upon the community and the Nation.

Improving the Load-Factor in Coal Mining.

The advantages of regular employment accrue alike to labor and capital; it is the year's earnings that really count, whether it is the dollar or the man whose service we thus measure. Now, if we study the country's soft-coal business as a whole we find a gratifying improvement during the war period in the average number of days of employment—from 195 days in 1914 to the top record of 249 days last year. But these averages for the country unfortunately include low figures for certain states and usually for the same states year after year, a relation that deserves this comment: wherever the working year is shortest there dissatisfaction with the conditions of labor is keenest—in other words, where the coal mines have not enough market to keep them running a long working year, there we find labor unrest. * * *

For three months last spring the coal mines of the country were operated, on an average, for only about 24 hours a week. From coast to coast the reason for lost time was "no market"—something beyond the control of either operator or mine worker. Here, then, is the greatest branch of our mining industry vitally affected by a widespread malady, the remedy for which lies with the public alone. Laws cannot make coal mines operate when there is no outlet for their product, but education of the consuming public may accomplish much in bettering the conditions of demand, and we as consumers will do well to remember that the price we pay for coal must in the long run be enough to pay for the idle days of both mines and miners, as well

as for the days they work. The public interest lies in a longer working year, not in a shorter day or week. * * *

As a suggestive comparison, I have taken the coal consumption of six large typical power companies—companies having an aggregate installed capacity of nearly 700,000 kw.—which furnish electric current to a trunk-line railroad and several street-railway systems as well as general lighting and power service in metropolitan districts. The daily average coal consumption of these companies by months during 10 months of last year furnishes a curve that shows a seasonal fluctuation similar to that of mine output, but the departures from the base line representing the average for the whole period are much smaller—92% is the spring low and 110% is the winter peak. Applied to the general curves of soft-coal production for several years, this consumption curve of six companies shows that for three-fourths of the time such power companies could exert a helpful influence on the market, even if they bought their supply from day to day. The storage of anything like a reasonable tonnage of coal at such plants would still further smooth out the curve and help to put the coal industry on a better basis. The influence of such consumers is well worthy of consideration, for these six companies alone use nearly one-half of 1% of the soft coal mined. It is also doubtless true that by connecting up such power units into a single system the improved load-factor would tend to smooth out the curve of coal consumption, and the pooled purchase of coal would further help abate the seasonal demand which is today the greatest evil in the bituminous coal industry.

The leaders in industry today are calculating the vision of a new type of prosperity tomorrow which must mean profit sharing on a thoroughgoing scale so that all concerned are to receive in proportion as they have served. The goal of wisely directed industry is the prosperous community of happy homes, and engineers must direct such industry.

Co-operation of Engineer and Accountant.

Yet the engineer must have the full co-operation of the accountant, if the returns from industry are to be fairly divided. A true diagnosis of the financial condition of any industry involves bookkeeping that states the real economic symptoms. * * * In the first place, such terms as "net earnings," "profit," "net income," "surplus," or "balance to surplus account," which appear on your financial sheets, are too optimistic in tone when the operating costs do not include any charge on account of the investment. The inference is too easily drawn that this surplus is available for profit sharing between labor and capital. For example, the Federal Trade Commission report on copper is quoted in newspaper headlines as showing "28% profit in copper," yet in this report, though the wage to labor is set forth as the first and largest item among the elements of cost, the cost of capital is not included. The report shows, however, that the 85 copper companies discussed would require an average of 3 cents a pound to pay 10% on their actual investment, yet this 3 cents does not appear in the 16 cents of average cost but instead it forms a part of the 8 cents so-called "net profit," which the unwary may regard as the actual difference between price and cost.

In the second place, I fear lest accounting which does not count all the costs may lead us to fail to appreciate the results of American engineering. Our engineers, backed up by red-blooded capitalists, are constantly lowering labor costs by increasing the investment in improved mine equipment. This means replacing the hardest part of labor with machinery—it means working dollars instead of men—so that your cost-keeping conceals the true state of things if you pay labor out of so-called "costs" and capital out of so-called "profits." By your improvement in equipment you are subtracting from one side of the account and adding to the other, thus ever making the margin apparently larger than it really is. The great strides in advancing our mining industry have come through large investments in plant and we must in fairness include a living wage for capital as well as for labor when we figure the cost of winning this or that metal from the low-grade ores, metal which a few years ago not all the labor in the world could have won for the use of mankind.

Engineer Must Assume More Active Leadership in Forming of Public Opinion.

In the January *Harper's Magazine* a leading press correspondent who is in the closest touch with the events of the day gives to his article on current tendencies in affairs of state the simple title "Political Cowardice." But even where the legislator or executive may be brave, too often he is not well informed. He does not have the point of view of the engineer, whose training in the exact sciences qualifies him to render yeoman service as a citizen. * * * The absurdity of the political logic that opposes direct transition to up-to-date conditions is strikingly exposed by Ibsen. "Suppose," he says, "a little town which has until now got along with oil lamps wishes to introduce electric lights, its water power being easily accessible and cheap, and an official comes along and says that temporarily they must erect gas works as, historically, lighting by gas is the intermediate step."

Those are some of the reasons why we need to unite in urging the engineers of the country to take a larger share in citizenship; indeed, these are compelling reasons for engineers to assume more of leadership in public opinion.

The engineer is a forward-looking worker but to get in fullest measure the pull of inspiration in our work, perhaps we need to hark back as well as look ahead. In planning to benefit our children we can gain courage and purpose by thinking of what our fathers did for us. * * * And all over our land, close to the busiest city streets and in the quiet places of the countryside are these reminders of the past and of those who had large faith in their country. We do well if we share that faith and pay our tribute to our fathers by planning for an America that shall be still greater because it is a land of many more and even happier homes. Prosperity of the right kind is all we can ask and all that we need to work for. If the door of large opportunity is to open wide for all our people, the key to unlock that door is good engineering.

Survey of Prevailing Conditions as to Industrial Lighting—II.

General Comments on Results Obtained—Facts About Lamps in Use—Disposition of Executives Regarding Lighting—Why the Lighting Has Not Been Kept Up to Date—Last Changes

In our introductory remarks and condensed partial summary of the industrial lighting survey made last year by Fuller & Smith, of Cleveland, O., for the National Lamp Works, we have shown that this survey was carefully planned and carried out so as to bring forth results thoroughly representative of the actual conditions prevailing. Nearly 450 plants were visited in 57 cities located in 15 of the leading industrial states. A general analysis of these plants was given in our last issue, together with the principal questions on which information was sought in each case. In the following we shall begin a somewhat detailed analysis of the technical and commercial results obtained.

General Observations on the Results.

There are five distinct lines of variation or fundamental gradations of industrial consumers with regard to their disposition toward factory lighting, their experiences or activities, or the degree to which they have been cultivated.

Accordingly the analysis of this particular market, or of any sales activity within the market, cannot be completed until these fundamental groups are taken into consideration and employed as a basis for cross analysis. What is true of the entire group on any specific feature will not necessarily be found true of subdivisions of that group according to these several gradations, which are:

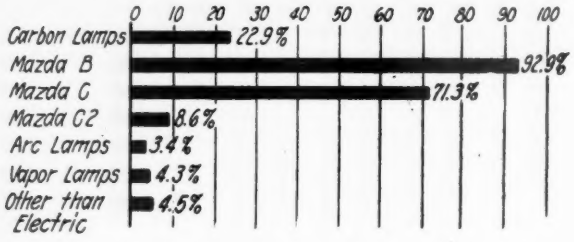

0 10 20 30 40 50 60 70 80 90 100
Carbon Lamps 22.9%
Mazda B 92.9%
Mazda C 71.3%
Mazda C2 8.6%
Arc Lamps 3.4%
Vapor Lamps 4.3%
Other than Electric 4.5%

Fig. 2.—Kind of Lighting Units in Use.

1. *Location.*—Distinct variations will be found when a group of industrial consumers in one section of the country is contrasted with a group in an entirely different section of the country, owing to a different degree of cultivation, different trade customs and practices, different industrial requirements, etc.

2. *Lighting Requirements.*—Distinct contrasts will be found between consumers with varying lighting requirements with respect to almost any feature of primary importance. Variations of lighting requirements are dictated as a rule by the diversity of the industries, but the lighting requirement, rather than the nature of the business, is the basis for grouping.

3. *Population Strata.*—Variations will be equally pronounced when consumers are divided into groups according to their location in large, medium-sized and small-sized towns.

4. *Ages.*—There is a distinct difference in a great many features between the traits and tendencies of the older concerns as contrasted with younger establishments.

5. *Size.*—The tendency of the average selling organization to concentrate greater effort upon larger establishments at the expense of the smaller ones, together with the lack of development of organization and lack of working facilities frequently found in smaller concerns, is reflected in a pronounced variation in their disposition toward the lighting proposition, and experience with it.

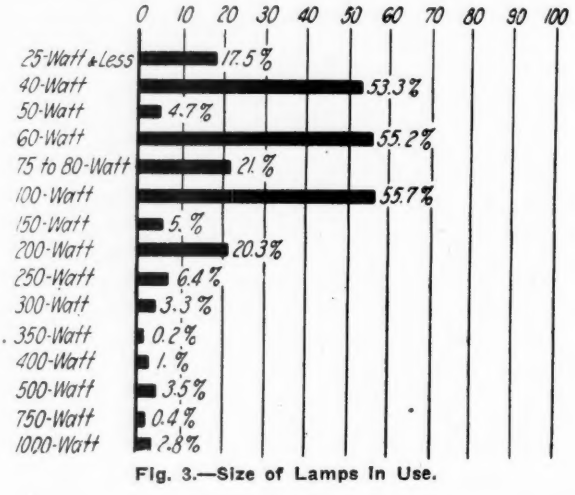


Fig. 3.—Size of Lamps In Use.

It is necessary then, in arriving at an analysis of this particular market, not only to determine what is true of the entire group considered as a unit, but also, at least upon the more important and significant features, to determine what is true of the smaller units which are created when the whole group is subdivided according to the foregoing classifications.

One of the most significant results of this consumer survey on industrial lighting is the determination of the specific proportion of concerns who have not made lighting changes, additions or improvements within the past five years, and who may accordingly be set down as having obsolete lighting at the present time.

The survey demonstrates that some 30% of the industrial concerns fall within this classification.

The fact that so wide a variation on this particular feature is found within the four territorial zones into which the sections covered by this investigation have been arbitrarily divided

for the purpose of cross analysis, seems to be a clear indication that this condition is chargeable in no small degree to the difference in sales activities in various territories. No doubt a certain proportion of this variation can be charged against the development of war industrial work with its unusual lighting requirements.

It was found further that the larger institutions have apparently been worked to the neglect of the smaller ones, and likewise there was a distinct indication that medium-sized towns, falling roughly within the class of from 25,000 to 100,000 population, have not received the attention that either larger or smaller towns encountered in this survey have received.

A vast difference was found in the disposition toward the factory lighting subject throughout the survey between the attitude of the executive and that of the technical employe, such as the superintendent or chief electrician. With the latter a marked interest in the lighting problem was always found and, as a rule, a pronounced degree of intelligence. With the former, or executive class, the interest elicited by this subject may be said to be of a latent or potential quality. The executive was not disposed to question the importance of the factory lighting subject within his business, except very rarely, but it was not among the foremost subjects in his mind as related to his business. It was an important issue, but it apparently was only recognized when the subject was brought to his attention.

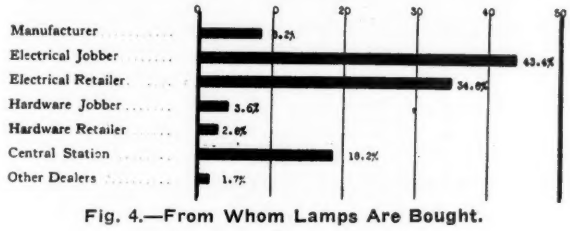


Fig. 4.—From Whom Lamps Are Bought.

There was a mild and sometimes a pronounced surprise that he should be questioned regarding such a subject. On the part of a large proportion there was a certain degree of complacency regarding the lighting situation, and an acquiescence in existing conditions, a tendency to modify, improve or replace lighting equipment only when necessity for such action arose from some aggravated condition.

Of the proportion who were definitely interested in the factory lighting subject and in the matter of improving their lighting facilities a large number of instances were reported in which such improvements were being withheld owing to the prospect of new building.

This survey accordingly confirmed the results of others recently made in the industrial field by the same organization in the promise which it held out of continual and increasing activity along the line of industrial building.

The investigation brought out clearly the increasing and widespread popularity of the Mazda C lamp. The Mazda C2 was also frequently referred to, particularly as lighting requirements become the more exacting, and several instances were encountered in which this had taken the place of the mercury-vapor units.

In the more progressive plants consideration of the employes and their requirements had an important bearing upon the disposition toward factory lighting. One of the parties interviewed expressed this idea effectively when he said employes now "must be handled with kid gloves."

In one plant the investigator noted that it "looked like Coney Island when lighted up." One side of the packing room was used for continual experimenting with lighting for better results. At this plant only girls were employed and it was found necessary to have proper lighting or it would take three girls to do as much work as one on a single job.

The proportion of plants still using some carbon lamps was rather surprising, but it was found that they were using them very largely very frequently, if not as a general rule, for the definite purpose of withstanding vibration rather than through failure to recognize the superior efficiency of Mazda B or C lamps. The new mill type Mazda lamp should meet this argument very effectively.

In several of the interviews, complaint was made with regard to the habit of employes of pilfering lamps for their own use, which was made to account for the empty sockets observed as the investigator went through these factories.

A very interesting reaction was secured when the question of cleaning lamps and reflectors was brought up by the investigator in order to determine the frequency or infrequency with which the lighting equipment was cleaned. Very often, the investigator reported, the party interviewed upon having this question brought up would stop

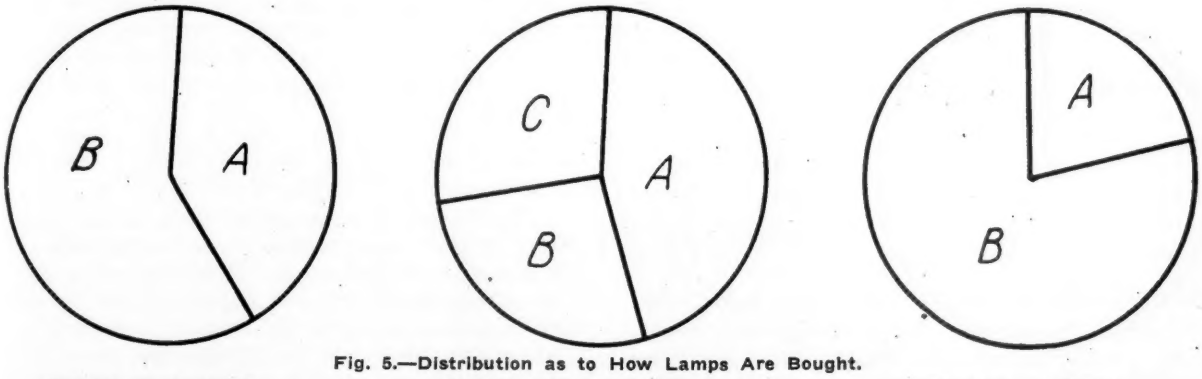


Fig. 5.—Distribution as to How Lamps Are Bought.

Bought on Contract.
A—Have contract, 42.2%.
B—Do not have contract, 57.8%.

Distribution of Patronage.
A—Wholly to one dealer, 47.5%.
B—Largely to one dealer, 25.6%.
C—To different dealers, 26.8%.

Specification of Brand.
A—Specify the brand, 23.6%.
B—Leave brand to dealer, 76.4%.

to make note or give directions that the cleaning be done at stated intervals thereafter.

There seemed to be considerable appreciation of the suggestion and it is apparent that education along this line would be welcomed by a great majority of the industrial consumers.

Results of the detailed analyses of the survey are given in the following comments, which are substantially in the same order as the various divisions of the questionnaire.

Facts About the Lamps in Use.

Kinds of Lamps in Use.—More than 90% of the industrial concerns called upon were using Mazda B lamps, which is by far the most common type of lamp in use. It is somewhat surprising to find that practically 23% of the industrial concerns are still using carbon lamps to some degree, although there were only five instances in which carbon lamps were used exclusively. Mazda C lamps are found to be in very general use also; they were being used in upwards of 70% of the plants reported upon. Less than 10% of the group were using Mazda C2 lamps, and less than 5% were using other than electric light. Fig. 2 shows the detailed analysis on this feature graphically. It will be noted that because many plants use several kinds of lamps, the total of the subdivisions in Fig. 2 is much over 100%.

Sizes of Lamps in Use.—The 40, 60 and 100-watt lamps are in most common use, being found in approximately 55% of the plants covered; 75

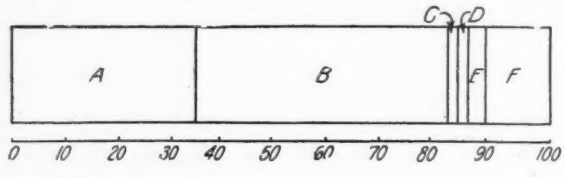


Fig. 6.—Disposition Toward Present Lighting.

	Per cent.
A. Entirely satisfied	34.4
B. Fairly well satisfied	50.7
C. Disinterested	1.6
D. Doubtful	2.3
E. Dissatisfied	3.4
F. Anxious to improve	8.1

to 80-watt lamps were used by about 20% of the plants, and 200-watt lamps by nearly the same proportion; 25-watt and smaller lamps were found in 17.5% of the plants, while the larger sizes, 250 to 1000, were reported by a moderate proportion.

Number of Lamps Used and Number Purchased Annually.—The average number of lamps in use throughout the establishment, the average being taken on 402 reports where this information was obtainable, was approximately 1250. The average number purchased annually, based upon reports from about three-fourths of the first group, was approximately 1270, indicating only a little more than an annual renewal of lamps throughout the average institution, or an average life for the individual lamp of a little less than one year.

From Whom Lamps Are Purchased, and Number Bought at a Time.—A greater proportion of the lamps were bought from electrical jobbers than from any other source, but not a majority, approximately 43% purchasing from electrical jobbers as against 35% purchasing from electrical retailers. The next most popular source of supply was the central station, which furnished 18% of the lamps, while the lamp manufacturer was found to furnish only about 8%. The hardware jobber and retailer divided about 6% of the total business between them, which accounts for practically all of the business with the exception of some 2% going to other sources. Fig. 4 shows the distribution in this regard.

A slight majority of the industrial plants ordered lamps in less than 100 lots, while about 28% ordered in lots of from 100 to 200 at a time, leaving only about 20% who ordered in larger quantities than 200. The number ordered at one time by the average plant is 66.

How Lamps Are Bought.—The analysis clearly shows that a trifle over 42% have annual contracts for lamps, while a little less than 58% buy on the open market. A little less than half of the industrial consumers patronize one dealer exclusively, while an additional one-quarter confine their patronage very largely to one dealer, so that only a little more than one-quarter of the

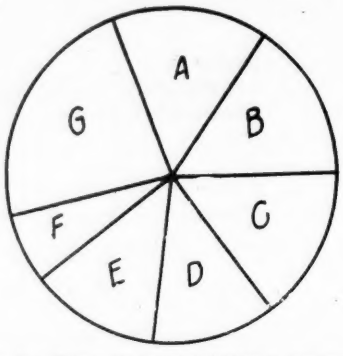


Fig. 7.—Time of Last Lighting Change.

	Per cent.
A. Within one year	14.6
B. One year ago	13.4
C. Two years ago	20.2
D. Three years ago	10.6
E. Four years ago	11.1
F. Five years ago	5.9
G. Over five years ago	24.0

total group seem to have the tendency to shop around among different dealers. Price and service is found to be the principal consideration for confining trade to a single dealer, while about 10% claim to be influenced in this respect purely by habit. Only about one-quarter of the concerns specify the brand of lamp, the remaining three-quarters leaving the brand entirely to the dealer. Paralleling this fact, that only one-quarter of the consumers specify the brand, is the feature brought out by this inquiry that less than 20% of them consider that there is any material difference between different brands or makes of lamps. The three diagrams of Fig. 5 show this analysis.

Disposition of Parties Interviewed Regarding the Lighting of Their Plants.

The combined opinions of those interviewed, who, it must be remembered, include executives, operators and electricians, show that some 85% were completely satisfied regarding the lighting of their plants, or at least quite well satisfied. About one-third expressed themselves as entirely satisfied. On the other hand, however, there were found 8% expressing themselves as anxious to improve the lighting of their plants, and about 3.5% dissatisfied, a total of 11.5% constituting a

field of low-selling resistance for this industrial lighting proposition. Add 2.3% rated as "doubtful" and there are 14% within this class. This is an analysis of primary significance, as indicating the condition of the field which the entire lighting industry has before it for cultivation. Fig. 6 shows this study graphically.

When Last Changes Were Made.

In line with this development of the survey is the equally significant feature that nearly 25% of the total were found to have made no improvement or addition to lighting system or equipment within the past five years, and that a total of nearly 30% had not made any such improvements or change for five years or more. The above two features clearly indicate, first, that from the standpoint of disposition toward their lighting, nearly 14% are doubtful as to its efficiency, dissatisfied or anxious to improve, while, on the other hand, from the standpoint of the length of time since lighting improvements have been made, it is found that about 30% of the field have not had lighting improvement for so long a period that their existing equipment may, no doubt, be rated as obsolete.

Cross analysis on this question as to the length of time since lighting changes or improvements

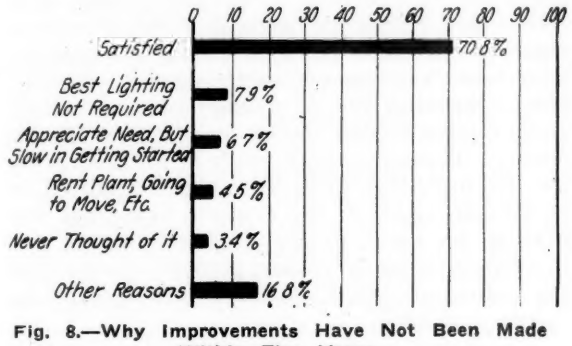


Fig. 8.—Why Improvements Have Not Been Made Within Five Years.

have been made shows a distinct difference between the four primary territorial zones that were drawn for the purpose of this cross analysis, as follows:

The proportion not having made any such improvements for five years or more is in zone A (Illinois and Iowa), 13.5%; in zone B (Michigan, Ohio, Indiana and Kentucky), 32.6%; in zone C (New York, Massachusetts, Connecticut, New Jersey and Pennsylvania), 18%; and in zone D (Maryland, Virginia, North Carolina and Delaware), 47.6%. This would seem to indicate that zone B has approximately two and one-half times as much obsolete lighting equipment as zone A, and nearly twice as much as zone C, whereas zone D has more than four times as much obsolete equipment as zone A, and two and one-half times as much as zone C.

Dividing the consumers into three groups from the standpoint of population, group A representing towns of 100,000 or more, group B towns of 25,000 to 100,000, and group C towns of less than 25,000, or in other words, large cities, medium-sized and small towns, it was found that there has been much greater activity in the change and improvement of lighting equipment in the larger towns than in the medium or small-sized towns. In the larger towns the proportion that had not made improvements within the past five years was 22%; in the medium-sized towns the proportion was approximately 39.5% and in the small towns it was close to 34%. This shows that the small towns are apparently worked to better advantage out of the large towns than are the medium-sized cities; while the larger cities show the effect of the most intensive cultivation.

For cross analysis on the basis of size there were established two divisions; first, that of the larger-sized plants and, second, that of the smaller. This shows about twice as much development on the part of the larger institutions as on the part of the smaller ones. In other words, the larger institutions show a proportion of 18% who have not made improvements within the past five years, while with the smaller the proportion is 37%.

Cross analysis from the standpoint of age is significant in showing that there is no great disparity on this feature, contrasting the results with respect to concerns ten years old or younger with those of concerns of a greater age. In fact, there was a trifle larger proportion of those who have not made recent improvements in the first division than in the second, indicating a somewhat greater tendency on the part of the older concerns to bring their plants up to date than on the part of the newer concerns.

Eighty-nine of the concerns who had not made improvements within the past five years gave their reasons for not making such improvements but these reasons were necessarily vague and of little consequence, the most important, given by 71 of the group, being that they were satisfied with present conditions. However, it is significant that 7% expressed themselves as appreciating the need of improvement, but have merely procrastinated in actually effecting such changes.

In the next and final section of the report on this survey will be given the analysis of such important features as to who controls the matter of lighting changes, who would be consulted regarding them, the general disposition of the executives as to lighting, opinions as to the advantages to be derived from better lighting, observations of the investigator as to the lighting actually employed, proportion of work done under artificial light, general familiarity of the plant officials with lighting developments, and other interesting features brought out in the survey.

(To be concluded.)

MELTING POINTS OF CHEMICAL ELEMENTS.

The Bureau of Standards has just isued Circular No. 35, fourth edition, entitled "Melting Points of Chemical Elements, and Other Standard Temperatures." This table of melting points and other fixed temperatures is based upon a careful survey of all literature, and in the opinion of the Bureau of Standards represents the most probable values. These are, however, in many cases subject to revision as more exact determinations become available. Centigrade temperatures are rounded off and the exact Fahrenheit equivalents are usually given.

Observations on Electrically Operated Pumps in Indiana

Forms and Types of Wells — Methods of Pumping Water Employed—Typical Installations—Operating Statistics—Paper Before Indiana Engineering Society

By G. C. BLALOCK

Instructor in Electrical Engineering, Purdue University.

According to available records there are 206 public water-works systems in the state of Indiana. Seventy-six of these, more than one-third, are operated partially or wholly by electricity. During the past winter and spring, 27 of these plants were visited by members of the Engineering Experiment Station staff of Purdue University with a view to ascertaining the present status of electrical operation of such plants. The results of this investigation, with other pertinent data, will appear shortly in the form of a bulletin issued by the Experiment Station.

Combined Pumping Plant and Engineer's Residence at Fairmount, Ind.

Observed Conditions.

The plants visited supply water to communities ranging in population from 500 to 25,000 and were found to be operating under a variety of conditions.

Fifteen plants used some form of elevated storage—tank, standpipe or reservoir; six were provided with compression tanks, the pressure being automatically controlled by pressure gauge relays; while the remaining six had no provision for storage but maintained direct pressure by continuous operation of the pumps. This probably represents in a general way the distribution as to types of plants over the state as a whole.

About 20% of the plants visited made use of deep-well pumps—air lift or displacement. The remainder used surface pumps, though in many cases the pumps were placed in pits from 4 to 15 ft. below ground level in order to reduce the suction lift.

The most commonly encountered source of water supply was the drilled well, 6 to 10 ins. in diameter and from 100 to 300 ft. in depth. In a few cases the supply came from streams or spring-fed reservoirs, but these were rather exceptional. The water from wells appears to be, in general, clear and pure, requiring no outlay for purification equipment. In most localities the water stands from 10 to 20 ft. below ground level, but in a few places the water flows to the pump under sufficient head to eliminate entirely the necessity for priming.

Centrifugal pumps and triplex displacement pumps were encountered in about equal numbers and the plant which contained neither of these types was exceptional. One rotary pump was observed handling the second stage of a two-stage system, and the city of La Fayette has three direct-connected motor-driven propeller pumps forming the first stage of a two-stage system, the second being handled by steam pumps. These, however, are held for emergency use, the first-stage pumping being normally done by air lift. Also in one case the first stage was handled by motor-driven deep-well pumps and the second stage by steam pumps. In 75% of the plants inspected, however, the single-stage system was used.

Alternating-current energy was utilized in practically all cases, either because direct current was not available or because the a-c. motor is cheaper, more rugged and requires less attention. Various types of a-c. motors were found to be in use, however, the choice depending chiefly upon type of pump to be driven. In most cases the available energy supply is 60-cycle, 3-phase, and the choice lies between the squirrel-cage and the wound-rotor types of induction motor, the former being used for driving centrifugal pumps where the starting load is light and the latter for driving displacement pumps where the starting load is relatively heavy. Exceptions were noted, however, to this general rule and in one case synchronous motors were found giving very satisfactory service. Single-phase, 25-cycle motors were encountered in one plant, the energy being obtained from an interurban railway transmission line which passed through the town.

The pressures in use for domestic service were found to range from 25 to 90 lbs. per sq. in., the average being about 40 lbs., corresponding to a head of 92 ft. In many cases provision is made for raising this pressure for fire-fighting purposes to 90 or 100 lbs. by cutting off the storage and bringing a special high-pressure unit into service. It is not uncommon to find steam pumps used for securing the extra pressure

needed for fire service, though the motor-driven fire-service pump is popular in localities where auxiliary steam equipment would be expensive to provide and maintain. There appears to be a growing sentiment in favor of securing the extra pressures by using a portable pump at the location of the fire rather than by boosting the pressure over the whole system, thereby making both mains and plumbing liable to damage or even complete failure at a time when such failure would be most serious. This method also eliminates the extra demand for water at service connections during the high pressure periods when the greatest possible supply should be available for fighting fire.

The average pump capacity provided for domestic service appears to be about 200 g.p.m. per 1000 population, but this figure is not of very great value since the capacity required depends very largely upon local conditions and may vary widely for towns of the same population. Also the system used has considerable influence upon the pump rating. A direct pressure system must have sufficient capacity to supply the peak of the load while in a storage system the pump needs to supply only the average demand, anything above this being drawn from the storage. The tendency is to provide too much rather than too little capacity in order to be on the safe side and to provide for future requirements. The pumping units designed for special fire service average about 250 g.p.m. capacity per 1000 population. These units also provide reserve capacity for abnormal demands other than for fire service.

Reported Conditions.

Town officials and operating men expressed themselves almost unanimously as well pleased with the results obtained through use of electrically operated equipment. Appreciation of the greater convenience and decreased operating expenses was especially marked in places where the pumps were previously steam driven. One plant was visited in which steam operation had been resumed after a trial of electric operation but no one available at the time could give an adequate reason for the dissatisfaction with the electric drive.

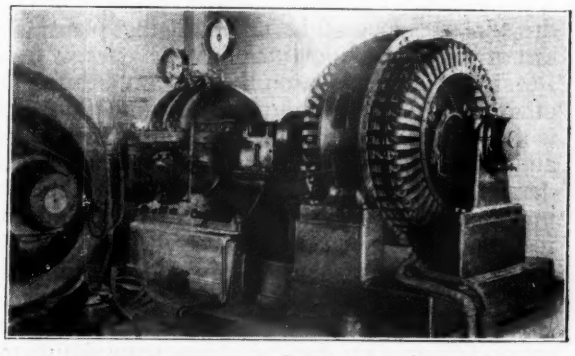
Another case of dissatisfaction was encountered where a direct-connected, motor-driven, centrifugal pump was giving unsatisfactory service, though no blame was placed upon the motor itself. The pump was obviously not designed for the conditions under which it was working and the result was an energy consumption very greatly out of proportion to the work done. Plans were being made to replace the centrifugal with a triplex pump though it appears likely that a change in impellers would have accomplished the same result. This served to emphasize the necessity for using great care in specifying a centrifugal pump for a given application, in order that its characteristics may be suited to the work it is expected to do.

Numerous cases of minor troubles with the equipment were reported. Of those directly chargeable to electric operation the only ones of serious import were those due to lack of adequate protective devices between motor and line. Some of these involved no serious consequences while others involved considerable expense and inconvenience, as well as fire risk. It would appear that the necessity for adequate protection of the motor and control circuits is not generally appreciated. The cost of such protective apparatus is not great and will soon be repaid through decreased repair bills and greater reliability of the equipment. Troubles were reported due to lack of reliable low-voltage and no-voltage cutouts and also to lack of proper protection against lightning. Good lightning arrester equipment properly installed is absolutely essential where power is secured from a transmission line and is the only means of preventing damage which may vary all the way from a breakdown of insulation in one or more coils to destruction of the entire electrical equipment.

Next to having the apparatus itself it is of importance that attendants should understand the significance of the protective devices. One plant was visited where no voltage protection was provided but a former attendant had decided that by wedging the starting handle in the full-on position he could start the pump from the power station and save himself a half-mile walk. Unfortunately the motor windings did not survive the initial experiment, but had to be entirely replaced.

The most frequent source of trouble, other than electrical, appeared to be due to freezing in severe winter weather. Bursting of pump cylinders were reported in numerous instances. In some cases these breaks had been repaired by welding, in others the cylinder had to be replaced. Troubles from this source can be charged only to neglect in providing some means for keeping the temperature sufficiently high to prevent freezing.

The installation of cheap equipment invariably results in troubles due to excessive wear and breakage; and poor judgment in the selection and use of equipment augments the difficulties along this line. In one plant the first stage was handled by an air lift and the second by a cheap rotary pump. The latter was driven at such high speed that it handled water faster than the air lift could supply it, so a portion was by-passed and pumped over again. In addition the wear on the impeller was so great as to necessitate its removal two or three times each year.



Interior of Bedford Pumping Station—100-hp. Westinghouse Synchronous Motor Driving 1100-g.p.m. De Laval Three-Stage Centrifugal Pump—Direct Pressure System, 250-ft. Head.

Troubles due to flooding sometimes occur in plans having the pumps located in pits. Unless the motor windings have been thoroughly waterproofed they are sure to be more or less perma-

nently damaged, with consequent shortening of their useful life, although the damage may not be such as to require immediate rewinding. Improper alignment of pump and motor causes undue wear and results in decreased efficiency and increased maintenance cost. The same cause sometimes results in broken rods in case of deep well pumps. Corrosion and rapid wear due to sediment in the water being pumped were reported in one or two instances.

The practice of selling water by meter appears to be rapidly superseding the old flat-rate system. Of more than 13,000 service connections reported, nearly one-third were metered. Four systems were entirely metered while only two had no meters at all. Many towns are changing over to the meter system as rapidly as circumstances permit and expect to have all connections metered within a year or two or just as fast as meters can be obtained.

Only six of the towns visited had provision for metering the pump discharge, despite the obvious advantage of having this means of checking the performance of the pump and motor. With a watthour meter on the input side of the unit, and water meter and pressure gage on the output side, the duty and overall efficiency may readily be determined at any time and any marked drop detected and accounted for. A centrifugal pump, particularly, needs to have its performance checked to avoid the marked drop in efficiency which occurs when the impeller is not properly designed for the conditions under which it is working. The substitution of an impeller of slightly different design may effect a saving which will pay for both meter and impeller within a comparatively short time.

Operating Records.

It was found rather difficult to obtain accurate records of plant operation and costs, particularly in the smaller towns. Combined power and pumping plants frequently do not provide separate meters for measuring the energy supplied to the pump motors nor divide the operating costs equitably between the power and pumping departments of the plant. Where energy is obtained from sources not owned or controlled by the interests operating the pumping plant, the meter provided often includes the energy used for street lighting, station lighting and heating, or other purposes; and, as previously mentioned, it is not often that provision is made for measuring and recording the amount of water pumped. The data obtained, therefore, involves estimates in many cases and should be considered as indicating plant performance in a general way only.

Data for calculating energy consumption per 1000 gals. of water pumped was obtained for 14 towns. In kilowatt-hours per 1000 gals. this energy consumption ranged from a minimum of 0.20 to a maximum of 3.28 kw-hrs., giving an average value for the 14 towns of 1.31 kw-hrs.

Since there is considerable variation in the total head against which these pumps are working a better measure of performance may be obtained by reducing the figure given for each plant to a basis of 100-ft. total head. This gives values ranging from 0.125 to 1.96 kw-hrs., with an average of 0.90 kw-hr. per 1000 gals. per 100-ft. head.

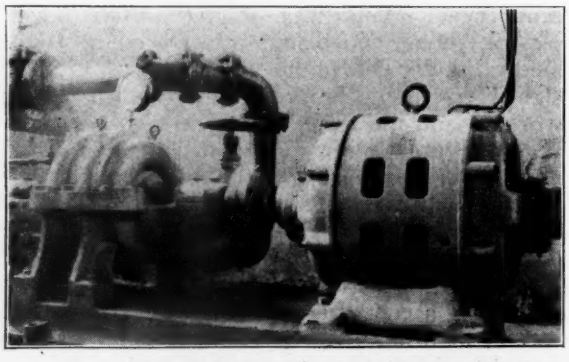
The operating cost per 1000 gals. was found to range between 0.88 and 16.83 cents, with an average value of 4.97 cents. Reduced to a basis of 100-ft. head this average becomes 3.74 cents per 1000 gals. per 100-ft. head.

Tests.

Two plants equipped with meters for measuring the pump discharge were selected, and tests were run, with two objects in view: First, to determine the duty and overall efficiency of the pumping unit, thus obtaining a basis for figuring energy costs per unit discharge; and second, to determine the nature of the power demand and thereby establish the degree of desirability of pumping loads from the central station point of view. The test in each case extended over a period of 24 hours, and in addition to kilowatt-hour and water meters a graphic recording wattmeter was used for measuring and recording the power demand.

The unit tested in the first plant consisted of a 2½-in., single-stage, 175-g. p. m., centrifugal pump, driven by a 15-hp. squirrel-cage type, induction motor; pumping continuously against the direct pressure of the mains. A total pumpage of 11,900 cu. ft. was observed—an average rate of 61.8 g. p. m.—against a pressure of 40 lbs. per sq. in. with input of 9.38 hp., giving an overall efficiency of 16.7%. Estimates based on pipe friction tables give about 10 ft. loss of head in elbows, valves, meter, etc., between the pump intake and the point at which the pressure gage was attached to the main. Including this loss of head raises the efficiency about 2%. This still gives a very low overall efficiency, but it should be noted that the pump is discharging but little more than one-third of its rated capacity; this resulting in the motor running at considerably less than its normal rating. Neither pump nor motor can, therefore, be expected to show very good efficiency. It is evident that this unit is not operating under the conditions for which it was designed, resulting in high energy consumption per unit output.

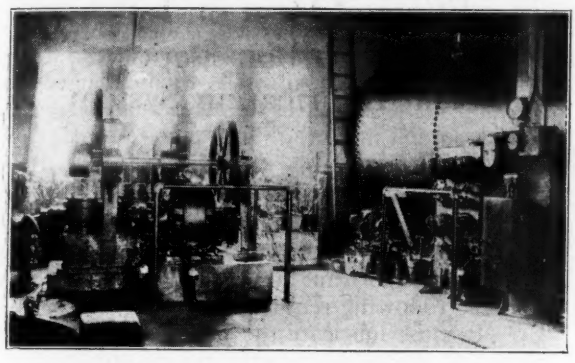
The unit tested in the second place consisted of a 4-in., 2-stage, 380-g. p. m., centrifugal pump, driven by a 25-hp., squirrel-cage induction motor; pumping to mains, with standpipe storage, the frequency and duration of pumping periods being regulated by a pressure gage relay and an automatic motor starter.



Fire Service Set at North Manchester—50-hp. Westinghouse Type C. S. Motor Direct-Connected to 520-g.p.m. Two-Stage Alberger Pump—246-ft. Head.

Three runs of approximately 2 hrs. each, at an

average pressure of 55 lbs. per sq. in., gave a pumping rate of 350 g. p. m., with an input of 32.35 hp. The overall efficiency was 38%. Estimated loss in head due to friction amounts, in this case, to about 35 ft.; an inclusion of this loss as part of the total head raises the efficiency



Goodland Plant, Showing Triplex Pumping Unit, Automatic Controller, and One of Two 18,000-gal. Compression Tanks—Motor 30-hp. Westinghouse Wound-Rotor Type—Pump, 250-g.p.m. Haberle.

about 10%. The overall efficiency in this case checks closely with manufacturers' estimates for this size and type of unit; and the unit is evidently well adapted to its work.

The conclusions arrived at as a result of investigation and study of the present status of electricity in the pumping plants of the state may be summed up as follows:

1. Where local conditions have been carefully considered, and the type and capacity of pump and motor which best suits those conditions intelligently selected, electrically driven pumps have proven highly satisfactory; they have been found to be easily handled, convenient, reliable and economical.

2. While the motor itself is very unlikely to give trouble, and transmission lines have proven quite reliable, yet it appears advisable to provide some auxiliary source of power. The automobile type gasoline engine appears particularly well suited to this purpose.

3. The energy consumption in properly designed plants may be expected to vary from 0.2 to 2.0 kw-hr. per 1000 gals. per 100-ft. head, with 1.0 as a fair average.

4. The operating expenses for an electrically operated plant are low: considerably below those for a steam plant and appreciably below those for an internal combustion engine plant.

5. The pumping plant load is a desirable one from the central power station point of view.

THERMAL EXPANSION OF INSULATING MATERIALS.

Data on Expansion Tests Just Published by the Bureau of Standards.

The Bureau of Standards has Scientific Paper No. 352, entitled "Thermal Expansion of Insulating Materials." This paper gives data from tests by Wm. H. Souder and Peter Hidnert on the thermal expansion of some of the more important insulating materials. In most cases the expansions are too irregular to justify the use of the general quadratic equations. A knowledge of the thermal behavior of these materials is essential before assembling them in certain types of electrical apparatus subjected to wide temperature variations.

Porcelain, bakelite, condensite, formica, celluloid, hard rubber, marble and limestone were the materials tested. The most striking peculiarities found are: (a) The wide range in the values of the coefficients of porcelain from 1.6 to 19.6 millionths per unit length per degree centigrade. (b) The three varieties of expansions for porcelain, namely, straight line, concave and convex expansion curves. (c) The shrinkage and the loss in weight of the phenol and similar compounds when subjected to excessive heat treatment. (d) The permanent growth and variations of different marbles when subjected to heat treatment. (e) The negative coefficient of expansion of marble at low temperatures.

Single copies of this publication may be obtained on request to the Bureau of Standards, Washington, D. C. Copies may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., for ten cents each.

NEW ENGLAND INSPECTORS CHANGE TITLE OF ASSOCIATION.

At the last meeting of the Western New England Section of the National Association of Electrical Inspectors, the name of the organization was changed to the Western New England Association of Electrical Inspectors, the change being made for the sake of brevity. The officers elected by the newly named association are Thomas Henry Day, 59 Deerfield avenue, Hartford, Conn., president; Joseph P. Rohan, Hartford, Conn., vice-president; Richard J. Forsyth, 247 Wells street, Greenfield, Mass., secretary, and Allen W. Hopkins, Springfield, Mass., treasurer. The new association will hold meetings in February, May and October of each year, but owing to the recent meeting the February meeting this year will be omitted and the next session held in Holyoke, Mass., May 12. At this meeting C. S. Randall, of the Volk Manufacturing Co., Westport, Conn., will explain the making of renewable fuses. Similar talks, explanatory of some device or material used in the application of electricity in industrial or home life, will be given at each meeting.

BUREAU OF STANDARDS ISSUES NOTE ON COEFFICIENT RADIATION.

The United States Department of Commerce, bureau of standards, has just issued scientific paper No. 357, entitled "Note on the Coefficient of Total Radiation of a Uniformly Heated Enclosure," prepared by W. W. Coblentz, of the bureau. Experimental data is given on the absorbtion of dry and humid air and the effect of atmospheric absorbtion is discussed. Single copies of the paper may be obtained free of charge by addressing the bureau of standards, Washington, D. C., or it can be obtained in quantities by applying to the Superintendent of Documents, Government Printing Office, Washington.

Approved Methods of Diesel-Engine Lubrication

Conditions Met Are Extremely Severe—Effect of Heat on Lubricant—Cycle of Gas Temperatures—Excessive Carbon Deposits, Attributed to Oil, May Be Due to Inefficient Lubricating System

By R. C. DE MARY

During my 15 years' experience as an operator and erector of steam and Diesel engines, I have come in contact with some of the best engineers in the United States. Until the coming of the internal-combustion engines, little attention seemed to be given to lubrication, but difficulties began to arise, which were attributed to lubrication and a closer study of the important function has resulted. However, the average engineer is still weak on the subject and can hardly be expected to be otherwise as there is very little literature relating thereto and that is written in such a manner that it is of no practical use to him. Nearly all articles I have come in contact with are too technical or else written in the interests of some special brand of oil. In the following discussion I will endeavor to be as practical as possible, so that the Diesel engineer may be assisted in his lubrication problems.

We all know that two metal surfaces rubbing together cause friction and that to reduce this friction we must use some kind of lubricant. This lubricant or oil must form a film that will entirely separate the two metal surfaces. We might say that the bearing surface floats on a film of oil.

A lubricant must possess three characteristics as follows:

1.—It must be capable of forming a film between two surfaces.

2.—It must have low friction qualities in itself.

3.—It must resist being squeezed from between the surfaces.

There are other qualities which a good lubricant for Diesel engines must have, but these three are the fundamental ones.

If an engine runs without giving trouble of any kind we know that it is well designed and that a good oil is being used. If trouble occurs we are sure of one or more possibilities:

1.—The oil may be poorly refined.

2.—It may not be fed to the cylinders in the right amount.

3.—It may be a good oil, but not suited for this particular engine.

4.—The engine or lubricating system may not be properly designed.

Trouble due to the first case is quite frequently encountered, though not so often where well-known brands of oil are used. The second case depends upon the vigilance of the engineer. In the third case it may be necessary to change oils and use one that is better suited to the engine. Fortunately trouble due to the last mentioned case is exceptional.

Lubricating conditions which are met in the operation of Diesel engines are much more severe than with steam.

A suitable lubricant for the former must have the three following requirements:

1.—It must lubricate the piston in an efficient manner at the high temperatures encountered.

2.—It must seal the piston and rings to prevent leakage.

3. It must burn without forming carbon in the cylinder.

The first requirement is an important one and depends on the viscosity, or in other words, its resistance to flow. The higher the viscosity the less fluid the oil, and this property decreases greatly as the temperature increases. Viscosity is generally expressed as light, medium, heavy, etc., though the viscosity of light, medium, and heavy oils may vary with different brands. For instance two light oils of different brands may differ greatly in viscosity. Thus we find that the higher the viscosity the thicker the oil, but we must not lose sight of the fact that all oils decrease greatly in viscosity with a very slight increase in temperature.

Degree of Gas Temperatures.

I have heard many engineers declare that they were using the "best" oil, yet they had lubrication troubles and always would because of the "extremely high" temperature in the Diesel engine cylinders. Let us see just what these extremely high temperatures are. Continued experiments have shown that a maximum temperature of about 2675 deg. F. is obtained at the starting of the power stroke, or upon ignition of the fuel charge. This temperature is lowered, as expansion of the burning charge takes place, and gradually jumps back to its maximum on the compression stroke. The minimum temperature is about 250 deg. F., with an average of about 945 deg. F., during a complete cycle. Now we must remember that these temperatures are those of the gases and not of the cylinder walls. Now the point to emphasize is the great difference in temperature between the gases and the cylinder walls, since this has an important bearing on cylinder lubrication.

Temperature of Cylinder Walls.

From a series of actual experiments conducted by W. B. Meriam it was shown that the cylinder walls had a temperature of about 30 deg. F. above that of the circulating water. Now just as long as the water is not boiling we know that the temperature of the walls is not higher than 250 deg. F. in a Diesel engine.

Action of Heat on Oils.

The action of heat on oils is determined by the flash point and the fire point. The flash point is the temperature to which the oil must be heated in order that the vapors given off will make a slight explosion when a flame is held directly over the oil. The fire point is the temperature to which the oil must be heated so that it will take fire and continue to burn after a flame has been applied. The fire point is from 40 to 50 deg. F. above the flash point.

Practically every oil used on Diesel engines has a flash point above 320 deg. F., and if the temperature rises above that there is something wrong, not with the oil but with the engine. Locate the trouble, and remedy it, but do not feed more oil or change lubricants.

Lubricating oil does not burn readily, and furthermore the time given it in the cylinder is very short. An engine running at only 100 r.p.m. would expose the lubricated surface of the cylinder to the action of the flame for less than one-quarter of a second. At higher speeds the time allowed for the oil to burn is so short that a flash point of as low as 300 deg. F. would be sufficiently high for any Diesel engine, except in the most unusual conditions.

Carbon Deposits Not Always Fault of Oil.

The chief trouble maker in connection with the operation of Diesel engines seems to be carbon deposits in the cylinder. The lubricating oil, of course, is blamed for this, when in nine cases out of ten, it is the operator, or in other words, a little more care and reasoning would prevent shut downs.

Carbon exists in two forms: First, fine carbon suspended in the oil and, second, in combinations forming hydrocarbon compounds which go to make up the oil. The amount of fine carbon is very small and the trouble from this cause in most cases is due to some other factor.

Advocates Asphalt-Base Oil Plus Graphite.

I have found in nearly every case where trouble was caused by carbon, that the engineer was using more oil than was necessary for the proper lubrication. An oversupply of oil in the cylinders will always cause the formation of carbon. Use an oil with an asphalt base, and not too heavy.

The addition of a small amount of graphite (about one teaspoonful to 1 gal. of oil) will assist in the lubrication and also, I have found, will, to quite an extent, assist in preventing carbon deposits. The amount of oil necessary to lubricate the cylinders of a Diesel engine depends on so many factors that it is necessary to solve the problem for each individual engine.

Oils made from the asphalt-base crudes of the Southern States are much superior to any others for Diesel engine lubrication. Those oils having a paraffine base, such as the Pennsylvania crudes, have a very low viscosity and to remedy this it becomes necessary to resort to compounding. The light oils are mixed with the heavier cylinder oils, and the latter is responsible for most of the gumming and carbon troubles due to lubrication. The asphalt-base oils are composed chiefly of the ethylene and the naphthene series[1] and distill without decomposition. No gum will be found in the cylinders or in the valves, and the fine carbon will nearly all be discharged through the exhaust.

The color of an oil, regardless of what the manufacturers claim, has no relation to its lubricating value. You can, however, tell if the oil is compounded with the heavy cylinder oils, for the reason that it will always show the green tinge of the latter.

Efficient Lubricant Feeder Is a Vital Necessity.

While every Diesel engine is equipped with a force feed lubricator, I regret to say that many of them are of little use. I have been called on several trouble cases where I recommended a change of lubricators and after installing the one I considered best for that particular case, little or no further trouble was experienced. Now I am not connected in any way with the manufacture or sale of lubricators for Diesel engines, but to my knowledge there is but one which I consider suitable for that purpose. This lubricator is driven by a lay shaft and is so adjusted that the pump plunger works in synchronism with the pistons. The oil is delivered directly onto the pistons, between the rings and at the end of the stroke. Now if we stay to consider for a moment we can see how important such a method is. The oil that does not strike the piston or is forced into the cylinder at such a time as the oil hole is uncovered by the piston is wasted and means just so much more carbon forming material.

Cutting Oil Consumption to Minimum.

Perhaps the following will give a better illustration of the above: Some months ago I was called to investigate a municipal plant in the Middle West, that was having considerable trouble. I found they were using one of the best brands of Diesel engine oils, yet it was not giving the satisfaction expected. I made a careful examination, and among the changes made and recommended was the purchase of a new lubricator. Now to get any kind of service from the oil, 80 to 85 drops per minute were being used in each cylinder. The new lubricator was installed and I cut down the oil to 40 drops per minute and found even this amount too much. After a few trials I found that about 32 drops per minute gave ideal results and from last reports no trouble has been experienced at the plant and the "chief" is greatly enthused because his carbon troubles have been almost entirely eliminated. Furthermore it does not require a great deal of figuring to determine the saving in the cost of oil at the above plant, which is one of the great many I have found in plants equipped in a similar manner.

The whole secret of successful cylinder lubrication is to use a suitable oil, and deliver a proper amount at the proper place and at the proper time.

The amount of oil required to properly lubricate the cylinders of a Diesel engine naturally depends upon several factors. The most important ones are design, style of lubricator, and quality

[1]These oils consist chiefly of hydrocarbons of the series $C_n H_{2n-4}$.

of oil. I have found that where an engine is well designed, and the temperature of the cooling water as it comes from the cylinders is not above 176 deg. F., I obtain best results on a feed of 18 to 20 drops of oil per minute, per cylinder, where the size is not above 16 ins. in diameter and 25-in. stroke. This amount of oil I would consider about right for all dimensions below those given, and where the revolutions do not exceed 160 per minute. Where the bore is from 16 to 25 ins. and the stroke 25 to 32 the average amount of oil is 25 drops per minute. With engines of this size the speed is naturally less, and the amount of oil is somewhat lower in proportion. These are average cases. Under some conditions I have found I could reduce the amount of oil mentioned and in others it was more than double the amount given above. The excessive requirement was due to poor rings, that is, rings which leaked badly, and an extra amount of oil was required to maintain a seal between the rings and the cylinder in order to keep up the compression. Where the lubricator is one that feeds the oil in synchronism with the engine piston, the amount of oil may in most cases be reduced a few drops per minute. If on removing a cylinder head a film of oil is found on the walls of the cylinder sufficiently thick to penetrate two thicknesses of cigarette paper, you will know you are getting a sufficient amount of lubricant.

In some cases a lubricator is divided so that one grade of oil is used in the cylinder and another on the bearings. I do not believe in this method as I know of many cases of trouble which were very expensive because the operator made a mistake in the oils. Furthermore the small saving in the cost does not warrant this method. Where the splash system is used, as it is in some cases, the oil from the crank pit should be renewed or filtered every 3 weeks where the run is 12 hours per day. If the pistons show any signs of leaking the oil should be renewed more frequently. Do not try to save on the oil at the expense of the engine, yet keep in mind that too much oil may cause harm.

Correct Viscosity an Imperative Need.

Beware of whom you buy your oils and be sure they contain no animal fats. Under ordinary working conditions an oil with a viscosity of not less than 200 at 100 deg. F. and a low cold test is recommended. If your engine is subject to overload, or is so located that the temperature of the room is high, a heavier oil should be used, one with a viscosity of from 300 to 400 and a low cold test. Sometimes the working conditions are very severe, and trouble is experienced from leaky rings and an oil with a viscosity of as high as 600 or 650 may be necessary.

Remember the color of the oil means nothing, neither does the density as a specific property, for when we mention light, medium, or heavy, we are concerned only as to viscosity. Light means low viscosity and heavy means high viscosity. Excessive friction may result from either too high or too low a viscosity. Too high a viscosity will give a good oil film, yet the friction in itself will be excessive. If the viscosity is too low the film will be broken. Get just as thin a film of oil as you can, yet have it perfect, and you have solved the lubrication problem.

Filter All Oils.

All oil should be filtered before using. This may seem needless with new oil but, even under the best conditions, foreign matter will sometimes get into the lubricant and, if filtered, this will be removed and be the means of preventing a serious shut down.

Where the engine has an enclosed crank case and uses the splash system on the bearings, the oil should be renewed frequently and filtered. The oil may seem to be in good condition but you will be surprised at the amount of sediment it contains, and which may prove detrimental to the bearings. We often hear the remark that "oil is cheaper than machinery," but we must remember that there is such a thing as overdoing the matter.

The appreciation of the foregoing principles should enable any one to obtain an oil suitable for his engine, and to use it in such a manner as to obtain the best results. I also believe that trouble due to carbon can be almost entirely eliminated by a study of its causes, and the use of a little judgment.

DIESEL ELECTRIC DRIVE IN FERRIS TYPE WOODEN VESSELS.

Advantages of Diesel-Engine Drive—Comparative Weights and Costs.

Contracts with a number of shipping plants around San Francisco bay have, it is reported, been let for the installation of Diesel electric drive in numerous wooden hulls constructed as steamers by the United States Shipping Board, but which are not completed because the Government decided that this type of ship was not a success. This has been announced by D. W. and R. Z. Dickie, naval architects, who have completed plans and specifications for the installation of the Diesel engines and electric drive. There are more than a score of these Ferris type hulls completed and waiting for the installation of the machinery distributed at various Pacific Coast ports.

Alexander Winton has arranged with Westinghouse Electric & Manufacturing Co. for electric motors and equipment. According to comparative figures prepared by the engineers, the new type of ship power has an advantage over the steam boiler and triple-expansion engine. The figures follow:

	Diesel Elec. Drive	Triple Exp. Plant
Indicated hp.	1,400	1,400
Weight of plant installed, tons	220	300
Fuel used per hour per hp., lbs.	45	1.25
Fuel used per hour, bbls.	1.9	5.4
Fuel used per day (at sea), bbls.	47.2	129.6
Fuel used per day (in port), bbls.	8	26
Cost of fuel oil per bbl.	$1.85	$1.60
Cost of fuel per day (at sea)	$87.32	$207.36
Cost of fuel per day (in port)	$14.80	$41.60
Days at sea	270	270
Days in port	95	95
Water used per day for power plant, tons	.....	3.75
Fuel used per day, tons	6.74	18.64
Weight of fuel carried, tons	220	650
Weight of water carried, tons	50	170

Cost of water per ton.....	$1.00	$1.00
Cargo carried in dead weight tons.....	3,400	3,000
Earning power of ship D. W. T., 1 year	$50.00	$50.00
Fuel used in year, bbls.....	13,504	37,462
Water used in yr. for power plant, tons		1,125
Total cost of fuel and water for 1 yr..	$24,983	$61,065

A unique feature of the new system is that the engines will be placed on the deck, aft, under the poop. Being placed directly over the twin motors which are geared to the propeller shaft, there will be only a short run of the insulated conduits, and the grave problem of adequate marine insulation will have been easily solved.

Each of the engines will have eight cylinders and having a high speed like that of an automobile, the twenty-four cylinders will cause but slight vibration. An extra athwartship bulkhead is to be placed under the engines as added support. One of the San Francisco bay shipbuilding plants has under consideration the construction of a fleet of steel vessels of the 4000 deadweight-ton class, which will have the Diesel electric drive installed.

FAMOUS DAMS RAISED BY PACIFIC GAS & ELECTRIC CO.

Interesting Phases of Hydroelectric Construction Engineering Shown in Work at Spaulding Lake During Last Year.

One of the most interesting phases of hydroelectric construction work effected during last year was the raising of the famous Lake Spaulding dam and the subsidiary dams on Lake Spaulding by the Pacific Gas & Electric Co. This work, just completed, places the big dam at Lake Spaulding 275 ft. above the bed of the South Yuba river.

Lake Spaulding is located in Nevada county, on the south fork of the Yuba river, and is fed principally from the melting snows. It has a drainage area of 123 sq. mi. Water is stored during the months of high run-off in Lake Spaulding and its tributary lakes, and is drawn out as needed during the period of low flow. This period covers about nine months of the year, hence one can readily realize the importance and value of such a large storage reservoir.

The addition of 15 ft. to the Lake Spaulding dams increases the storage capacity of the reservoir from 63,000 to 74,000 acre-ft. Each acre-ft. of storage represents, with the present power installations, approximately 1500 kw-hrs., so this year's increased storage should mean about 15,000,000 kw-hrs. increased power output. That, in brief, tells the story, so far as concerns the immediate benefit for the "Pacific service" system from the new construction work.

Those familiar with this company's South Yuba-Bear river development will remember that the original plans called for a dam at Lake Spaulding 305 ft. in height. The main dam was constructed to a height of 225 ft. in Dec., 1913, the foundation being built to take the ultimate section. In 1916 the dam was raised 35 ft., making it 260 ft. high. The work just completed has brought it up to 275 ft. The big dam will undoubtedly never be raised again, because of the fact that storage can be developed much more economically at other places on the same watershed. The explanation for this is that in order to further increase the height of the main Lake Spaulding dam it should be backed up with concrete, beginning at the foundation, constructed in 1913. This would necessitate the placing of an immense amount of concrete for a comparatively small quantity of storage.

Dam No. 2 is the spillway dam. This structure is constructed as a gravity type arch dam on a 300-ft. radius curve. The spill crest is 270 ft. long by 5 ft. deep, and is provided with flashboards to catch the last run-off of the season and thereby to raise the water level to the top of the dams. The down-stream face has what is called an Ogee-shaped surface, which deflects the spill water in such a way that it leaves the apron of the dam horizontally.

Dam No. 3, as completed, is of a partial gravity type, thrown into an arch, with a 200-ft. radius to conform with the topography of the ground. The central portion of the dam is reinforced between two buttresses at 40-ft. centers, in order to utilize the small dam that already existed (constructed in 1916) and to span a rather deep pot hole in the gorge between the two abutments of the dam.

Dams Nos. 4 and 5 are unique in that there is no precedent of an addition being made to a gravity type dam by means of buttresses. The top 15 ft. of these dams are of the gravity type, but below this section the old gravity section is backed up with buttresses 6 ft. thick and 30-ft. centers, designed to make the entire center, as completed, act as a gravity section. These dams, as originally laid out, were arched in plan, with a radius of 800 ft., principally to conform with the topography of the rock and to save concrete. As completed, the west end of Dam No. 4 has been flattened out to a radius of about 2000 ft. in order to join up with Dam No. 3.

PRINCIPLES OF RADIO TRANSMISSION AND RECEPTION.

Bureau of Standards, Washington, Compares Two Types of Aerials.

The Bureau of Standards has published Scientific Paper No. 354 on the above subject, copies of which may be had from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents each.

The functioning of the two principal types of radio aerials is worked out quantitatively from fundamental electromagnetic theory. Experiments have verified the formulas and conclusions presented. Formulas for the current received in either antenna or coil aerial in terms of current in either type of transmitting aerial are given, as well as comparison formulas giving the relative performance of antenna and coil aerials under various conditions. The advantages of the condenser type of aerial are presented. The theory and nature of radiation are discussed and applied to the elucidation of some current fallacies. The basic principles of design of aerials are given and desirable lines of future research are pointed out. The use of the coil aerial as a direction finder, interference preventer, reducer of strays and submarine aerial are not among the subjects treated.

Editorial Comment

Conservation Up to the Engineer

For some ten years we have heard much about conservation of our natural resources. The agitation of this subject has been quite generally well meant, but unfortunately not always well informed. Thus it took Congress practically ten years to enact a water-power development law because so much misinformation was injected into the discussion. In our state legislatures also conservation has not always been handled in a statesmanlike manner but has frequently deteriorated into a political issue. The bane of politics is that, instead of first having made a scientific study of all the facts, it is likely to make sweeping assumptions and on these build up a pet theory that is likely to prove popular. The scientist or engineer, on the contrary, first makes a thorough investigation of the facts, then points out the general lines of policy that should govern the solution of the problem, and finally works out a solution that will fit the facts and the policy selected.

From past experiences we can hardly expect our legislators to take the lead in conservation measures. They have not the training nor time to make a proper study of the question and there are among them too few that are real statesmen with the power to visualize what conditions are likely to confront future generations. And yet the problem is becoming of increasing importance day by day. Our consumption of fuels, for instance, is mounting at an extraordinary rate from year to year and plain regard for the welfare of our children and their descendants must prompt us to give most thoughtful consideration to conservation questions.

A scholarly presentation of this interesting problem was made by Dr. George Otis Smith, director of the United States Geological Survey, in an address before the Philadelphia Engineers' Club last week. In slightly condensed form we reproduce this excellent address on other pages of this issue because it should receive the widest possible publicity among engineers. Dr. Smith aims to arouse the engineering profession especially to serious thought on this engrossing subject because he looks to the engineer to work out the solution of the many angles of the problem in the light of a broad-minded grasp of the problem as a whole. He advocates that engineers undertake the education of the public to the importance and magnitude of fuel conservation as a national problem and to the vital necessity of systematic planning of power development to meet the steadily increasing demand for power most economically.

The engineer must come out of his shell and take much more active interest in public questions. It is now becoming recognized by many that a considerable number of public questions involve engineering problems. Naturally the special training of the engineer makes him the logical agency for their solution. But his training must be broadened so he will have a better grasp of public affairs.

Fire Hazards in Low-Voltage Farm Lighting

Prevention of fire and accident hazards due to use of electricity was the main topic discussed at the annual convention of the Western Association of Electrical Inspectors at St. Louis this week and many suggestions pertinent to the best interests of the industry were brought out.

One of the more important suggestions advanced had to do with the inspection of farm-lighting plants. Few people, even leaders in the electrical trade, realize the rapid growth that is being made in the installation of these plants. And there is a particular fire and accident hazard in these installations due to the fact that there is practically no provision made for inspection of such plants either at the time of installation, or afterward.

Farm-lighting plants as a rule form a peculiar type of fire hazard as nearly always the equipment is for low voltage and, as electric flatirons, fans, washing machines and other electrically operated machines are in as general use, comparatively speaking, in farmers' home as in those of city dwellers, the necessary high wattage to operate these devices must come through very heavy current in the wiring in use, thus greatly increasing the fire hazard unless that wiring has been properly designed and installed.

One suggestion that would at least be a starting point in a system of inspection for farm-lighting plants, was that means be provided so that state fire marshals be advised of every installation of such plants. To accomplish this though would need the passage of new laws in each state and the formation of electrical inspection bureaus by state marshals, for which there is already some need in other quarters.

Need for More Working Capital

That public utilities are not alone in finding it difficult to obtain suitable expansion of their working capital is shown by the fact that most large industrial corporations of the United States have found that their working capital for the last year or two has not kept pace with the growth in gross business.

This is a natural consequence of rising prices for finished products, for materials, and for labor. It is further qualified by the fact that it has been necessary to set aside large sums as reserve funds to meet federal taxes, which are figured as current liabilities, thereby decreasing the excess of quick assets over quick liabilities.

As a general thing, it is necessary that the proper relation be maintained between working capital and gross sales with respect to the particular requirements of the business, if that business is to prosper. Great expansion of gross without relative increase in cash assets is not a good condition, unless there exist special conditions tending to overcome the deficiency.

The corrective of this general situation has found expression in the large amount of financing which has been done in the last year or so by industrial companies, which, doing the largest business in their history, have found themselves cramped for working capital to swing it. This applies even more generally to some of the smaller industrials, than to the larger ones.

It will be seen that in the case of all the large industrial concerns cited in the appended table, taken from a leading daily, the proportion of working capital to gross sales has failed to maintain its pre-war relation:

	Working Capital Last Fiscal Year	% of Gross	Working Capital 1914	% of Gross
American Hide & Leather	$14,246,986	50	$ 9,146,278	53
American Locomotive	12,326,840	33	35,508,423	42
Baldwin Locomotive.	21,204,926	17	11,923,227	85
Central Leather.....	75,934,105	80	54,786,487	90
Lackawanna Steel...	24,596,942	29	16,540,932	101
Mexican Petroleum.	8,823,097	31	3,662,456	60
Republic Iron & Steel	29,257,961	39	10,565,203	48
Railway Steel Spring	5,049,963	20	3,728,478	75
Texas Co.....	88,015,443	109	36,827,571	121
U. S. Steel.....	485,354,599	28	227,201,750	41
Virginia Carolina Chemical	36,124,739	22	20,647,380	33

Public utilities, especially companies furnishing electric light and power, have made a record in financial management during the war and reconstruction period which is nothing short of phenomenal. Having had little or no recourse to the method by which industrial corporations maintain profits and attract new capital, viz., increased prices, they have still been able to find the necessary capital for operation. How long they can continue to do so without some relief from oppressive laws and regulations is, of course, problematical; but the record to date is one of which central-station officials may well be proud.

Accidents' Human Toll

Last year there were 80,000 men, women and children killed and more than 250,000 seriously injured through accidents in the United States. To these vast figures must be added another army of those whose injuries were less serious, in many instances such that their injuries and the accidents causing them never came to the attention of the statisticians.

More human beings were killed through accident last year than were claimed among America's fighting forces during the World War. Their deaths were incidental to our mode of living and our views of life. Not all, of course, but many of these deaths could have been prevented. Likewise many of the accidents that caused pain and suffering and expense to a quarter of a million people were unnecessary.

It is impossible to realize the suffering and agony, mental and physical, that was caused by accidents last year, that are caused every year. It is easier to calculate the financial loss, to the individual and to the nation as a whole, that such accidents entail. And the figures become the more staggering, the more unbelievable, when it is remembered that most accidents could have been avoided, if somebody had not erred, if somebody had not been careless, thoughtless or ignorant.

Safety or accident prevention is a matter of education, of teaching and developing public opinion. And such a crusade has long been bravely carried on by the National Safety Council, which is working not for financial gain, but for humanity—the noblest incentive of all. It behooves all of us to support and back up the National Safety Council as best we know how, for it is doing magnificent work in a sacred cause.

Meanwhile we can practice safety, preach safety and live safety. And we must remember always that while we may predetermine the performance of materials and structures, we cannot foretell what the human being will do from one minute to the next. The human element is the unknown quantity, the variable. It is the weakest link in the chain. Make safety rules, employ safety appliances, leave no stone unturned to make life safer. But while doing these things, remember that it is education of the individual, it is to make each person more thoughtful, less careless, more decisive and forever conscious of his and her responsibility, wherein lies the chief real hope for greater safety and fewer accidents.

Current Events

Reduction of Fire Hazards Considered by Inspectors—Brooklyn Edison Gives Dinner to Leaders in Community

INSPECTORS DISCUSS ELECTRICAL FIRE AND LIFE HAZARDS.

Accident Risks and Inspectors' Problems Chief Topics at St. Louis Convention of Western Association of Electrical Inspectors.

Over 100 members of the Western Association of Electrical Inspectors convened at the fifteenth annual convention of the organization at the Planters' Hotel, St. Louis, Jan. 27-29. An exceptionally busy and comprehensive program was arranged under the direction of President C. K. Cregier and Secretary-Treasurer W. S. Boyd, and as a result the sessions during the three days were brimful of information and suggestions to the inspectors in attendance.

Prominent among the papers presented were several dealing with the causes and reduction of fire hazards incident to electrical installations. Two sessions devoted to discussion of inspectors' problems brought out a broad interchange of ideas concerning inspection practice in the different cities represented by delegates. Other topics considered were the introduction of high-voltage current into buildings, the responsibility of public-service companies for safe wiring on consumers' premises, and the elimination of conflicts between the National Electrical Code and the National Electrical Safety Code. Reports of the various committees brought out a mass of information that contributed largely to the success of and benefit derived from the convention.

In characteristic southern style St. Louis extended a warm and hospitable greeting to the delegates. The St. Louis Electrical Board of Trade tendered banquets and theater parties to the delegates and made their stay in that city highly enjoyable as well as profitable. Mayor Henry W. Kiel opened the first session with a cordial welcoming address, to which response was made by Vice-President K. W. Adkins, Kansas City, Mo., who presided at the convention in the absence of President C. K. Cregier, Chicago, who was unable to attend.

High-Voltage Service Substations.

Two symposiums, one dealing with the introduction of high-voltage current into buildings and the other with regulating electrical appliance hazards featured the program. H. J. Woods, Missouri Inspection Bureau, St. Louis, presented the Underwriters' viewpoint of the first subject. His paper dealt with the installation of high-voltage substations for serving mercantile and manufacturing plants, pointing out the precautions that must be taken in making such installations to reduce fire hazards. He quoted from the Missouri Inspection Bureau's specifications for making such installations and in closing made mention of the relation of fire hazard to the over-fusing of transformers on the primary side and of the grounding of secondary.

In presenting the central-station viewpoint of the same subject, W. H. Millan, Union Electric Light & Power Co., St. Louis, gave a description of modern equipment and practice for making installations of transformer apparatus and vaults for the purpose of serving industrial plants from high-voltage lines.

In commenting upon the papers, V. H. Tousley, Chicago, asked two questions; first, that since the Code required suitable switch equipment at the service entrance, did or did not the installation of remote-control switch on the high-tensile side conform to the rules? second, what was the opinion of the inspectors present as to approval of such an installation? N. Rosseau said such installations should be treated as substations and that opening of remote-control switch on high-tension side insured dead equipment on the secondary side; that when service comes in on a pole line, disconnecting switches should be installed, and as there were many kinds of service entrances it was necessary for inspectors to use good judgment in passing on such installations. He also brought up the question of whether secondary switches should be omitted if remote-control switches were placed on the primary side.

Tells Engineers' Experiences.

H. B. Gear, Chicago, said that on a 2000-kw. installation it was impractical to install a service switch on the secondary side because of the massive construction necessary to carry such large current and that switching could be better handled on the primary side. As to over-fusing and setting circuit-breakers high on secondaries it was the experience of central-station engineers that such practice was not disadvantageous. All things considered, over-fusing at 100% will result in small percentage of the transformer burnouts experienced. It is becoming universal opinion that such practice does not result in fire hazard when transformers are installed in properly constructed vaults.

W. S. Boyd, Chicago, said it was his understanding that the Code rules would permit of the setting of the circuit-breaker so that it would operate somewhat under the safe carrying capacity of the secondary circuits; also that it desirable from an operating standpoint to overset circuit-breaker, thereby avoiding many service interruptions that were expensive and of no avail. Other discussion brought out points against the use of service switches on the secondary, one being that the installation of such

switches increased the liability of imperfect electrical joints, and this aside from the high cost of these switches. The concensus of opinion seemed to be, in the absence of specific Code rules on the question under discussion, that the installation of remote-control switches or disconnecting switches on the high-voltage side of service entrances of large capacity was good practice and that inspectors could approve these installations if the construction and operation of such equipment involved negligible fire and accident hazard.

Use of Incandescent Lamps in Dusty Places.

A paper on the use of incandescent lamps in dusty places was presented by C. L. Dows, National Lamp Works of General Electric Co., in which the development of the incandescent lamp was reviewed. He said that the reason the gas-filled lamp reached higher temperatures than the vacuum-filled lamp was that the heat was radiated in a different manner. A chart showed that for the vacuum-filled lamp 6% of the wattage input was developed as light, 86% as heat, and 8% absorbed by the leading-in wires; while for the gas-filled lamp, 8% was developed as light, 67% as radiated heat and 18% as convected and conducted heat, and 7% absorbed by leading-in wires. He said the maximum bulb temperature of the larger sizes of gas-filled lamps was found to be 360 deg. F., and the figure for 200-watt and smaller was 200 deg. F. The kindling point of most combustible substances averaged about 500 deg. F. This margin of 200 deg. meant that no fires could be started by lamps except when ventilation was shut off. Illumination in installations where dust abounds, such as flour mills, grain elevators, lumber mills, etc., presented fire hazard where flagrant violations against good practice were made in the installation and operation of such equipment, but that, properly installed, the incandescent lamp will meet all requirements as to fire hazard.

The discussion consisted of questions on the effect of dust in the temperature of lamps and as to the temperature at the base of gas-filled lamps, the latter question being made with a view to possible damage to wire insulation and to fiber linings of sockets and receptacles.

Analysis of Electrical Fire Causes.

C. H. Lum, National Board of Fire Underwriters, New York, presented a paper on this subject in which he stated that the National Board of Fire Underwriters started to systematically classify fire causes in 1914 with the result that 28 separate classifications were made, electrical causes being one of them. During the past four years from 8.3 to 8.6% of the fires reported in the United States have been attributed to electrical causes. A specific study of electrical fires for the week beginning Jan. 11 showed 540 fires, of which 252 were caused by flatirons, 82 by defective cords, and 206 by other causes. This shows the predominance of fires caused by electric flatirons. Misuse of portable cords for extensions, especially by amateur electricians, is shown to be great. Of the 206 miscellaneous fires caused by electricity, 76 were in attics or basements, showing the effect of tampering with exposed service wires in the effort to make extensions. Defective fixtures were responsible for 19 fires, motors for 6, and crosses of trolley wires with service wires for 11.

In closing, Mr. Lum pointed out that in spite of the safeguards thrown around the use of electrical devices, still they were the cause of many fires. Carelessness on the part of the public in handling such devices is ascribed as the principal reason and the education of the public as to proper precautions is considered the important remedy. Changing original wiring installations was named as bad practice, and another point is that more emphasis should be laid on the fact that deterioration of insulation in wiring installation involves much hazard.

Symposium on Regulating the Electrical Appliance Hazard.

The duties of the manufacturer, the contractor and dealer, the central station and the inspector in regulating the fire and accident hazards incident to the use of electrical appliances were outlined in four papers covering the situation from each viewpoint.

Speaking for the manufacturers, N. E. Long, Edison Electric Appliance Co., said engineers were giving the utmost attention to the safety of all appliances. Much experimental work is being done in the effort to develop an automatic electric flatiron that would reduce fire hazard to a minimum. Radiant heaters are being equipped with gravity switches that open the circuit should they accidentally be tipped over. A movement should be started to prevent the use of 32-volt sockets and receptacles on 110-volt lines, a practice that brings about fire hazard. He said his company planned to install 60 service stations through the country for the purpose of repairing appliances and advising consumers as to their proper use.

The electrical contractor's and dealer's viewpoint was explained by A. C. Brandt, Frank Adam Electric Co., St. Louis, who pointed out the fact that in the average home a number of electric devices, and some of high wattages, are used on circuits which were designed primarily for lighting alone. He advised the use of larger sizes of wire in new installations to obviate this difficulty, and suggested that in addition to the lighting circuits, other circuits should be provided for power, baseboard receptacles being connected to the latter. Intelligent salesmanship by dealers should include definite instructions to customers as to the hazards involved by the incorrect use of any appliance and of using a number of high-wattage appliances on circuits of small capacity. The dealer generally is giving more and more of such advice, but it is the non-electrical merchandiser of appliances that cannot and does not so help the customer to reduce fire hazard.

In order to realize on the papers on the subject of regulating the electrical appliance hazard, it was voted, at the suggestion of V. H. Tousley, that a committee be appointed to review the papers and discussion and make a report at the next convention of the association.

At a luncheon given by the St. Louis Electrical Board of Trade on Tuesday, J. H. Fenton, St. Louis Fire Prevention Bureau, presided as chairman of the day, and V. H. Tousley, chief electrical inspector, Chicago, addressed the mem-

bers and the visiting inspectors on inspection problems. He outlined the functions of the electrical inspector and told of the value of inspection to the public at large. He gave illustrations of the workings of an inspection department and said that electrical interests should co-operate in the prevention of fire and accident hazards and not wait until something serious happens before concerted action is taken.

Lack of Rules for Farm Lighting Inspection.

The dearth of rules to cover inspection of farm-lighting plants was emphasized together with the necessity of such inspections. It was suggested that means be provided so that state fire marshals be advised of every farm-lighting plant installation in order that inspections could be made. The growth of the farm-lighting industry was considered as a reason why adequate means for handling their inspection should, and would, be evolved. The question of providing lightning protection for farm-lighting plants also came up for discussion and the urgent need of such protection shown.

Trouble with electrical installations in refrigerating, cold storage and chemical plants because of the rusting of conduit and deterioration of insulation brought up the question as to the best practice in this regard. Specifications as such installation, including the use of hot galvanized conduit installed so that it is practically self-drawing, were given by those who discussed the subject.

Other problems discussed included those on installation of motors in grain elevators, grounding of outer cases of transformers in pole-line construction, and the use of conduit from service entrance to cutout box.

Reports of the various standing committees were made during Thursday's sessions and mention will be made of them in next week's issue.

BROOKLYN EDISON TENDERS DINNER TO 350 INDUSTRIAL LEADERS.

Representative Gathering Hears Speeches from Electrical Heads and Others Urging Better Civic Spirit.

"Boost Brooklyn's Products" and "Be a Better Brooklynite" were the keynotes of a dinner given by the Brooklyn Edison Co. at the Hotel Bossert, Brooklyn, Jan. 13, when 350 men, representative of the industrial, commercial and financial enterprises of Brooklyn and many city officials of the borough were the guests of the company.

The keynotes of the dinner were set forth in electric letters emblazoned on the walls, with other electric decorations in the way of amber lamps installed in the big crystal chandeliers and garlands of pink roses extending from fixture to fixture adding to the pretty decorative effect.

Lewis H. Nixon, Public Service Commissioner of New York state, was the principal speaker, taking as his subject, "The Regulation of Public Utilities." He advocated a plan to establish a "flexible fare" based upon the cost of service that will pay the cost of operation, taxes and a fair return on the investment.

The growth of Brooklyn and the efforts of the Brooklyn Edison company to keep stride with the remarkable expansion of Brooklyn enterprises during the past two years was told by M. S. Sloan, president of the company.

Theodore I. Jones, general sales agent of the company, and toastmaster of the dinner, presented an exhaustive survey of the industrial situation in Brooklyn. He said "In any given year Brooklyn produces more manufactured goods than Pittsburgh and Minneapolis put together and the yearly output of such manufacturing cities as Lynn, Lowell and Lawrence,

Representative Brooklyn Industrial, Commercial and Financial Men and City Officials at Dinner Tendered Them by Brooklyn Edison Co. at Hotel Bossert, Brooklyn, Jan. 13.

Mass., added together is less than one-half the value of manufactured goods produced in Brooklyn in a year's period." Mr. Jones indicated the growth of the Brooklyn Edison Co. by the fact that in 1909 there were 9900 hp. contracted for industrial purposes, in 1912, 25,585 h.p., in 1916, 50,870 hp. and in 1919, 65,165 hp.

William E. Halm, president of the New York Dock Co., spoke on "Some Phases of Brooklyn's Industrial Development." "Employers should make a very close study of the labor question," said Mr. Halm. "Workmen listening to the I. W. W. hear only one side of the story. When a man is told that out of every $5 he earns, his employer makes $50, he believes it, if his employer does not disillusion him. Employers must work with their men on a thoroughly equitable basis in order to increase production and meet labor conditions."

Brooklyn Borough President, Edward Riegelman discussed the marginal railway, Jamaica Bay development and the general expansion of Brooklyn, while experiences at Berlin directly following the World War armistice were told by Brigadier-General G. H. Harries, who represented the Allied forces in the German capital at that period.

At the guest table were Messrs. E. A. Baily, N. F. Brady, Hon, F. E. Crane, J. S. Davis, H. P. Erwin, J. H. Post, R. C. Carter, J. C. Van Duyne, W. F. Wells, Col. G. F. Downey, F. W. Rowe, M. S. Sloan, L. H. Nixon, W. E. Halm, Hon. Edward Riegelmann and Theodore I. Jones.

The committee in charge of the dinner were as follows: Wm. H. Wells, advertising manager, chairman; R. C. Bach, J. M. Cohen, S. W. Diossy, H. G. Disque, L. P. Hayden, B. Irwin, G. J. Leibman, H. S. Musgrave, F. H. Sears, M. S. Seelman, Jr., and S. H. Van Cott.

ELECTRICAL EXPORTS FOR NOVEMBER SHOW HEALTHY INCREASE.

Electrical exports to foreign countries during the month of November, 1919, totalled $6,704,184, as against $6,177,252 for the same month in 1918, an increase of $526,932, a healthy increase for the month but a falling off from the average that was maintained in the trade in the first 10 months of 1919 when the average monthly increase in exports was over $2,500,000.

For the first 11 months of 1919 the total electrical trade export amounted to $82,424,051, against a total of $54,795,552, an increase for 1919 of the splendid total of $27,628,499. Total exports in 1917 were $49,542,599.

The above facts are gleaned from the monthly summary of the foreign and domestic commerce of the United States for last November published by the Bureau of Foreign and Domestic Commerce, Washington, D. C. The following classified figures, obtained from the same source, give the detailed data for November compared with the corresponding month last year:

Articles.	1919.	1918.
Batteries	$ 406,722	$ 350,162
Carbons	61,971	211,191
Dynamos or generators	617,981	300,230
Fans	68,298	35,307
Heating and cooking apparatus	117,772	54,617
Insulated wire and cables	535,746	398,956
Interior wiring supplies, including fixtures	174,640	153,310
Lamps—		
Arc	1,904	274
Carbon filament	41,501	14,845
Metal filament	253,963	423,533
Magnetos, spark plugs, etc.	237,604	260,796
Meters and measuring instruments	156,655	219,620
Motors	1,003,864	925,171
Rheostats and controllers	40,655	63,048
Switches and accessories	229,941	206,828
Telegraph apparatus, including wireless	37,147	51,767
Telephones	373,610	188,429
Transformers	157,381	554,116
All other	2,186,829	1,765,052
Total electrical machinery, etc.	$6,704,184	$6,177,252

COMING CONVENTIONS.

United States Independent Telephone Association. Winter convention, Atlanta, Ga., Feb. 4-6. Secretary-treasurer, W. S. Vivian, 19 South LaSalle street, Chicago.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., Feb. 9-13. Secretary-treasurer, Charles H. Hofrichter, Cleveland, O.

Oklahoma Utilities Association. Annual convention, Oklahoma City, Feb. 10-13. Secretary, H. A. Lane, 611 State National Bank building, Oklahoma City.

American Institute of Electrical Engineers. Midwinter convention, New York City, Feb. 18-20. Secretary, F. L. Hutchinson, 33 West 39th street, New York City.

Central Electric Railway Association. Annual meeting, Louisville, Ky., Feb. 26-27. Secretary, A. L. Neereamer, Indianapolis, Ind.

American Electrochemical Society. Annual convention, Boston, Mass., April 7-10. Friday, April 9, joint session with American Institute of Electrical Engineers on "Electrically Produced Alloys." Secretary, Joseph W. Richards, Bethlehem, Pa.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 39th street, New York City.

National Association of Electrical Contractors and Dealers. Annual convention, Baltimore, Md., Oct. 6. Secretary, W. H. Morton, 110 West 40th street, New York City.

PENNSYLVANIA ASSOCIATION TO HOLD MEETING NEXT MONTH.

The Pennsylvania State Association of Electrical Contractors and Dealers will hold its annual meeting at the Lawrence hotel, Erie, Pa., on Wednesday, Feb. 18, according to advance announcements sent out by Albert Gentel, of Philadelphia, state chairman. The tentative program includes a meeting of the executive committee at 10 a. m., a noonday "Acquaintanceship" luncheon, with a business session in the afternoon, followed by a trip through the plant of the General Electric Co. The session will conclude with a dinner at 7 p. m. at which all branches of the electrical industry will be represented.

USES OF THE AUDION IN RADIO SERVICE.

The annual meeting of the Radio Club of America was held on Jan. 23 at Columbia University, New York City. A paper on "Some Uses of the Audion in Present Receiving Systems" was read by Lewis M. Clement, engineer of the Western Electric Co.

Commercial Practice

Byllesby Ownership Plan — Public Stock Ownership — Traction Difficulties — Other Central-Station Activities

BYLLESBY COMPANY'S CUSTOMER OWNERSHIP PLAN COMMENDED.

Pueblo (Colo.) Newspaper Gives Reasons for Urging Investment in Utility Stocks.

The six electric and gas companies under the management of H. M. Byllesby & Co., Chicago, which sold their preferred stock direct to the public served by them during 1919, distributed $3,387,100 par value of such stock during the year, there having been 5700 separate sales. At Louisville, Ky., the sales represent a period of only about 45 days, the offering first being made about the middle of November. At a number of the properties there were no special drives or selling campaigns, while the San Diego company has had no preferred stock available for sale for several months:

Results for the year for the various companies were as follows:

Company—	Number of Sales	Par Value Preferred Stock
Northern States Power Co.	4,314	$2,479,700
San Diego Cons. Gas & Elec. Co.	212	287,900
Louisville Gas & Electric Co.	494	224,700
Arkansas Valley Ry., Lt. & Power Co.	305	183,500
Oklahoma Gas & Electric Co.	278	151,600
Western States Gas & Electric Co.	97	59,700
	5,700	$3,387,100

In connection with the selling of stock direct to people of the community wherein the stock, be it utility or industrial, is well known, the Pueblo (Colo.) *Sunday Opinion* in a recent issue says:

"For years the *Opinion* has urged the wage-earners of Pueblo to invest in Pueblo industrial stock for two excellent reasons:

"First: As an investment for your money where you could be in touch with it.

"Second: Any wage-earner is liable to lose his job at any time, but far less likely to if he is with a concern that he holds stock in. Every corporation prefers employes who are also stockholders because of mutual interests. If a worker holds stock in one to six of Pueblo's plants do you imagine he will long be out of a job? It is better for him to have one, or more places in which he can get work than none at all.

"Among the perfectly safe corporations in this city for every wage-earner to buy stock in is the Arkansas Valley Railway, Light & Power Co. The company is going to make many improvements—mostly here in Pueblo, where every citizen can see, and is offering some stock to our citizens, and the *Opinion* believes that every worker who can spare $5 or more per month should subscribe for some at once. Perhaps some day you will be glad you did so if it only brings you a job.

"Anyway, you will feel better when you receive a check every three months paying you 7% interest.

"Business men ought not to have to be told that it is part of their duty to good citizenship to back up all industrial plants."

TRACTION SITUATION FACTS SHOW NEED OF INCREASED INCOME.

Shrinkage of Security Values Has Already Cost Investors Hundreds of Millions.

Interesting facts, having to do with the electric railway situation, are given in a pamphlet compiled from statements recently made before the Federal Electric Railways Commission in Washington. The pamphlet entitled "What Is to Be Done with Our Electric Railways," lists the facts in the traction situation as follows:

"Rise in prices; materials for service have risen between 1916 and 1918 an average of more than 100 per cent.

"Wages have risen since 1916 about 120 per cent and are still going up.

"Size of industry; capital about $6,000,000,000. Employs about 300,000 men. Has 44,000 miles of track.

"New capital needed for extension and improvements about $700,000,000 a year.

"Service rendered; the electric railways of the United States carry ten times as many passengers as the steam railroads.

"Losses to investors; shrinkage of security values has already cost investors hundreds of millions of dollars. They will invest no more under present conditions."

The conclusion drawn from the facts is that the industry cannot survive without increased income. A very important part of it must have relief at once.

PRACTICALLY EVERY CITIZEN IS PART OWNER OF UTILITIES.

Carl D. Jackson, Chairman Wisconsin Railroad Commission, Makes Interesting Statement.

Practically every citizen of the United States now owns public utility securities, whether he is aware of the fact or not. The explanation of how the billions of dollars of securities, representing investment in public service companies, have become so widely distributed as to bring universal ownership about is shown in an analysis of the extraordinary situation by Carl D. Jack-

son, chairman of the Wisconsin Railroad Commission, in which he says:

"The actual ownership of most public utilities is by the people themselves. The first liens on most public utilities are very often owned by trust companies, banks and largely by insurance companies throughout the United States. Nearly every man carries an insurance policy. The average citizen has a bank account, yet not one citizen out of a hundred realizes that in one form or another his actual savings and insurance and his wife's and children's welfare depend upon the solvency and continued operation of public utilities.

"There is probably not one man in 50 whom we meet on the street who does not own a part of a public utility, whether he knows it or not. So the questions relating to public utilities are not confined to the consumers on one side and the public utilities as such on the other, but the whole question is one involving financially nine-tenths of the entire population.

"Furthermore, public utilities should not only be solvent in themselves, but there should still remain a reasonable incentive to reasonable development along the lines to be demanded by future generations. Nothing should take place in this country to discourage individual and collective efforts along progressive lines."

A TYPICAL SMALL POWER COMPANY OF THE NORTHWEST.

North Coast Power Co. Supplies Many Towns Over High-Tension Lines—Considerable Irrigation Pumping Load.

The North Coast Power Co., having its principal offices at Portland, Ore., is typical of the smaller power companies of the Northwest. It serves light and power to a number of towns in the state of Washington, comprising Woodland, Kalama, Kelso, Castle Rock, Vader, Winlock, Napavine, Chehalis, Centralia, Bucoda and Fenino; Ranier on the Oregon side is also served. It has a steam-electric plant at Chehalis and a hydroelectric plant at Kalama, the two having a capacity of 2200 kw. The company has 72 miles of 45,000-volt transmission lines, some of which extend to pumping plants in diking districts where about 510 hp. is required during the spring and summer. The consumption of power during 1919 amounted to an increase of 20% in kw-hrs. over that of 1918. The 1918 increase in kw-hrs. over that of 1917 was about 9%. A considerable increase of power load for 1920 is anticipated.

NEW ORLEANS RAILWAY FIRM CONDUCTS INTERESTING CAMPAIGN.

Display Cards in Cars Bring Out Problems of Company in Appealing and Understandable Manner.

The New Orleans Railway & Light Co. is conducting an interesting campaign of education as a means of convincing the public that an increase in fares is necessary. The campaign, which is under the supervision of John S. Bleecker, general manager, is conducted by means of posters and placards carried in the regular advertising space in the cars. The method of conducting the campaign is not new, since it is employed by numerous street railway companies, but the facts and comparisons indicated on the cards and posters attract attention by their novelty and convey to the readers some of the problems confronting the company in a way that is understandable and impressive. Perhaps the convincing nature of the posters lies in the fact that they contain numerical data that the average person can understand rather than abstract and purely general terms.

CAN OBTAIN GOOD SERVICE ONLY BY JUST AND EQUITABLE TREATMENT.

An increase in fares charged by the Fort Smith Light & Traction Co. has been authorized by the Arkansas Corporation Commission. The new fares, which became effective Jan. 16, are on the bases of 6 cts. cash, nine tickets for 50 cts. and 19 tickets for $1. A report of the commission finding for increased fares, written by Commissioner T. E. Wood, says:

"The law forbids the establishment of rates whose effect will be confiscation of property of utilities. It has been shown to the satisfaction of the commission that the existing rates with the present cost of operation are, in fact, confiscatory. What the commission has no legal right to establish, it has no moral right to maintain. It is time for the public to realize that the powers conferred upon public service commissions, thoroughly tested and upheld by the courts are ample for the protection of the public against all the evils from which they have suffered in the past. It is time also to realize that good service can be obtained only by just and equitable treatment. The utilities have been deprived of the power to make unjust profits, they should also be protected against unjust losses. After a utility is driven into a position where its credit is impaired and it can obtain money for operation only at an unreasonable cost, the public must share the loss."

LOST MONEY SELLING CURRENT.

A recent incident experienced by the sales department of the Northern States Power Co. illustrates the present day difficulties encountered by the small central station in endeavoring to supply electric service.

Bellevue, a small town in southwestern Minnesota, inquired from the Northern States Power Co. as to the possibilities of obtaining electric service from their lines several miles away. Investigation showed that the town would have to spend some $20,000 or more in building a line to the company's nearest transmission line. While this investigation was in progress a private individual who operated a small electric plant in the town and supplied service to a proportion of the citizens approached the representative of the power company and requested that every effort be made to hasten the building of this line.

He stated that he was supplying electric service at 50 cts. per kw-hr. and was losing so much money that he was anxious to get out of the business as soon as possible.

Operating Practice

Powdered Coal in Philadelphia—Failures and Factors Affecting Turbogenerators—Burning Lignites Under Boilers

LARGE POWER PLANT TO APPLY POWDERED COAL.

Important Installation to Be Made by Philadelphia Rapid Transit Co.

The Philadelphia Rapid Transit Co., after careful investigation, has decided to equip its Mount Vernon street power station with a powdered coal system for firing the boilers, using river and buckwheat anthracite coal.

This plant has at present a capacity of about 75,000 kw., employing twenty 375-hp. B. & W. water-tube boilers. With powdered coal firing, the needed output will be secured with only ten boilers, although the fuel to be used is low in volatile matter and high in ash content. Considerable economies are also expected to be realized through greater combustion efficiency, saving in labor and ability to use a much lower grade fuel than that now in use.

The change from hand fired to powdered coal will be made without interruption of service; and the new installation will be completed during the coming summer.

FAILURES OF TURBOGENERATORS.

British Operating Engineer Reviews Their Causes—Suggests Water Cooling.

The failures of turbogenertaors were dealt with very fully from the point of view of the operating engineer, suggestions for improvements being also put forward by J. Shepherd at the Institution of Electrical Engineers in London in January. The author said that each increase in size of machines opened up new difficulties for solution and consolidation. The operating engineer usually occupied a position of greater freedom to criticize, to represent the difficulties experienced, and within the limitations of his knowledge to indicate certain new ideas likely to be helpful in overcoming defects than did the designer. As a rule, serious failures with turbogenerators only developed when machines were of large size and formed units in a system of some magnitude. Under these conditions any fault on a single unit might then be fed from the collective energy from several machines until the protecting relays of the switchgear had operated. As a result the failure of a turbogenerator was usually more or less complete and if, as generally happened, the machine was set on fire, it might be several hours before it was cool enough for examination. By that time the charred remains were in such a condition that evidence of the cause of breakdown usually had been entirely destroyed, and it became a slow and painful business to diagnose with any certainty the source of weakness and with confidence to prescribe a remedy. Mr. Shepherd said that after several years of experience in many stations and with different designs of machines, the more usual types of failures had been determined and might be roughly classified thus: (1) Mechanical weakness; (2) electrical weakness; (3) heating and fire risk; (4) ventilation difficulties. The various defects were very closely related. After discussing these he said that from the operating point of view, the requirements of modern turbogenerators were reliability, efficiency and ease of operation. Reliability called for machines which should be fireproof, the coils of which could not break down or overheat, the insulation of which should not fray, crack or deteriorate, and the electrical joints of the machine should be so constructed that there was no chance of their giving way under load. Most operating engineers would consider reliability the most important of the three conditions and would be willing to obtain it at the sacrifice of some electrical efficiency. Ease of operation required some better means of knowing what was happening inside the enclosed frame of the machine. It ought to be possible to determine continuously, with some accuracy and by simple means, what was the temperature of any part of the machine, and it was desirable to anticipate breakdowns by the indication of rising temperature of the faulty part, or otherwise, before the fault developed. The output of the machine should be independent of air temperatures and if possible there should be some reserve of capacity to meet sudden overloads.

Several causes of failures mentioned were considered and the remedy for each type of failure was briefly discussed under the following heads: Rotor coils' centrifugal force; rotor couplings; stator cores; stator windings; joints; heating and fire risks. The author said that his "suggested improvements" had been more or less introduced into the latest designs of turbogenerators but even the best of modern machines appeared to stop short of the perfect generator. Consideration of the usual defects mentioned showed that air with presence of hot spots; (2) weak conties: (1) Impossibility of equal distribution of air with presence of hots pots; (2) weak construction of stator, open type of end windings and serious fire risks; (3) larger diameter of rotor with greater centrifugal forces; inadequate cooling of end winding loops; (4) higher temperatures than desirable, with reduced life of insulation. The ideal machine must be free from these defects and should also embrace the following features: (a) Coils to be continuously held against movement under mechanical forces but free to expand with heat; (b) working temperature and output independent of air condi-

tions; (c) capable of working at a much reduced temperature and to be practically fireproof.

The author said that machines constructed to embrace these features would undoubtedly be much superior to those at present manufactured if the modifications did not introduce other difficulties either in construction or in operation. To obtain these advantages, all windings, including rotor end loops and stator end connections, would be contained in continuous metal winding slots with adequate freedom for expansion. The windings would be securely supported over their entire length and the heat generated in the copper would be directly conveyed to the surrounding supporting metal and dissipated by liquid cooling. If the principle of liquid cooling could be accepted and completely developed as a practical feature, there were a number of important modifications which at once became possible. Air ventilation, with the difficulties of cooling and cleaning, became unnecessary and the fire risk of machines largely disappeared if there were no air to feed the flames. By splitting up the water paths in the machine and by providing adjusting cocks in the water supply to each cooling device, it became a simple matter to determine the temperature of each part of the machine and to adjust the water flow to give a uniform temperature with elimination of hot spots and having regard to the superior cooling effect of water over air, a lower temperature would be possible with enhanced life of the insulation. A further and great advantage would be in the provision of continuous supports to the end connections of both stator and rotor windings, which were at present the weakest features of most generators. Mr. Shepherd next considered the combination of water cooling and coil supports and a general comparison of air and water cooling.

In his final notes the author said that whether we liked the idea of liquid cooling or not, the question would have to be faced in the immediate future and the full consideration of its uses gave an opportunity of considering alternator design from a new point of view. The designs he had described offered the following advantages over air-cooled machines:

Rotor. (1) Smaller diameter with reduced centrifugal stresses; (2) mechanical support to end winding loops and steel tape bands; (3) efficient heat paths, low working temperature, less fire risk and longer life.

Stator. (4) Solidly supported core and teeth with reduction of vibration; (5) continuous mechanical support to windings; (6) efficient heat paths, low working temperature, less fire risk and longer life; (7) adjustment of amount of cooling to every portion, with elimination of hot spots.

The physical life of any plant apart from breakdowns, was determined by the wear of moving parts, fatigue of such other parts as might be subjected to fluctuating stresses or, in the case of insulation, by prolonged heating combined with mechanical stresses.

Having regard to the necessarily few moving and wearing parts of a turbogenerator, namely, journals, bearings and slip-rings, there appeared to be no sound reason why it should not have as long a physical life as the low-speed plant it had superseded, provided it were possible to construct machines which did not overheat, the coils of which were efficiently and continuously supported against all stresses and vibration, and that the fire risk was removed. With machines constructed in which the features indicated in the paper were embraced, a much longer physical life might be anticipated. With dear money and expensive plant, longer physical life would be an economical necessity of the immediate future. Mr. Shepherd expected his proposal to substitute water cooling for air cooling to be adversely criticized but, he added finally, "all new ideas must be so treated; at the same time, without novelty there can be no progress."

GOOD EFFICIENCY OBTAINED WITH LOW-GRADE LIGNITES.

Boiler Tests at Minnesota Power Plant Give Combined Efficiency of 68.9 Per Cent.

The town of Moorhead, Minn., operates a power plant for providing light and power and for supplying the town with water. The plant contains two 2200-volt, 60-cycle turbogenerators totaling 800 kw. Steam is supplied by two 202 b.hp. Stirling boilers which are served by Jones underfeed stokers.

The location of this plant is such that the fuel that can be most reliably and conveniently used is lignite from North Dakota. The grade of lignite used is known as Montana Round-up, a lignite of the following proximate analysis:

	Per cent.
Fixed carbon	23.87
Volatile	36.34
Ash	6.93
Moisture	32.86
Sulphur	0.87

Tests recently carried out to determine what was to be expected as regards combined efficiency and also ability to increase the rates of steaming gave very good results, as is brought out in the accompanying test data. Special attention is drawn to the boiler capacity obtained and combined efficiency at regular output of the boilers. The results are most worthy when it is remembered that the lignite being used as fuel contains as much as 32% of moisture.

	At regular load.	Under heavy load.	Capacity test.
Coal burned per hour as fired, lbs.	1061	1734	2533
Coal burned per hour per retort, lbs.	531	867	1267
Water evaporated from and at 212 deg. F. per hour, lbs.	5246	8007	10237
Water evaporated from and at 212 deg. F. per sq. ft. of heating surface per hour, lbs.	.....	.....	.....
B.hp. developed (average)	152.1	232.1	296.7
Per cent of rated capacity developed	76.1	116.1	148.4
Water evaporated actual per pound coal as fired, lbs.	4.59	4.27	3.71
Water evaporated from and at 212 deg. F. per pound of coal as fired, lbs.	4.94	4.62	4.05
Water evaporated from and at 212 deg. F. per pound of coal dry, lbs.	7.37	6.88	6.03
Water evaporated from and at 212 deg. F. per pound of coal combustible, lbs.	8.22	7.67	6.72
Efficiency of boiler, furnace and grate, %	68.9	64.5	56.5

Contracting-Construction

Tramp Steamer Electrical Installations—Opportunities in Factory Lighting—Improved Conditions in New Orleans

ELECTRICAL INSTALLATION ON AMERICAN TRAMP STEAMERS.

A Plea for More Care in Installing Equipment—Common Mistakes—Greater Use of Electricity Would Promote Economy.

By Thomas Hallinan,
Marine Engineer.

The "tramp" steamer differs from the liner to the extent that its sailings and ports of call are not scheduled, except for the voyage, and these are changed to suit the exigencies and the demands for carriers of ocean freight. The tramp may go any place from "hell to breakfast" at any time, but she is always on her way.

When the machinery breaks down or breaks up while running over the long trade routes, there is no well equipped repair shop "around the corner," with mechanics, spare parts, tools and supplies to go to. The engineers aboard must keep her running to get into port, but many of the ports of the world do not even have a good supply of carpet tacks, let alone tools or machine parts.

The liners usually run between important ports; they are well built and supplied generously with tools and spares. With the regular engineers, they have junior engineers and electricians. The tramp steamer, on the contrary, seldom carries more than the chief and the watch engineers.

It is of transcendent importance that the machinery and the construction work on these steamers should be the best obtainable, especially the electrical equipment, because the marine engineers, although they have a good working knowledge of electricity, are not as a rule electricians, and at sea the electrical work must operate under the most difficult conditions.

It is the well ordered details on board a ship that keeps her running steadily and running economically. A day's delay on the average steamer may cost between $1000 and $2000. It is the little things which in the aggregate will permit the American merchant marine to compete successfully with the other maritime countries.

Six bells are never struck in the second "dog" watch on English ships and they haven't been struck since the time Nelson "slipped one over" on the crews of his ships. The crews got an injection of "I. W. W. stuff" somewhere and decided on a mutiny which was to start at six bells in the second dog watch. Nelson became cognizant of the plan and the officer of the deck never passed the word to strike six bells and therefore the mutiny never happened. The English have a clever way of carrying on this old stuff to keep alive the romance and adventure of the sea, but it seldom interferes with new improvements which make for a successful merchant marine.

We also have traditions of the deep sea on our American ships and it seldom interferes with the application or operation of new machinery or equipment; but in the United States we have not the unity between the builders and operators which is found in the British shipping. I shall take as an example of lack of co-ordination the installation of the electrical equipment on some of the recently built ships.

It is very apparent that the men who design and install this equipment have never been to sea with the decks awash and the spume and spray filling the air with salty moisture in every part of the ship, nor do they exchange ideas with the men who are responsible for the equipment on the high seas; nor, evidently, do they look over their work after the ship has made a few deep-water trips with periods of heavy weather.

The following is a partial list of errors in electrical construction that are being made in the ships that are now being built.

Errors in Electrical Installation Commonly Made.

Deck bushings, both on the open main decks and between decks, are made of steel conduit, threaded the full length and held to the deck with iron washers and iron locknuts. Obviously, this should be salt-water-resisting metal, especially on the main decks which are often awash for days at a time.

The threads on the steel conduits are commonly left exposed at the fittings and couplings and often improperly leaded, which leaves them open to the action of the salt moisture. The galvanizing on the ordinary conduit soon breaks down under the action of salt water. More substantial galvanizing should be done or an effective coating of liquid asphalt should be devised.

Utility has been sacrified for appearance in the use of conduit fittings for often there is not space enough for properly insulated splices and the bearing surface for the rubber gasket is not wide enough for a water-tight joint. For marine work these fittings should be made larger and with a wider gasket surface.

Metal molding has no place anywhere aboard a ship, in the opinion of the writer, for the washdown hose soon makes the ground lamps blink.

Lead-covered, steel-armored, flexible cable I find has three strong objections to its use aboard ship. It is subject to mechanical injury to a much greater degree than rigid steel conduit is when cargo or heavy machinery parts are han-

dled on shipboard. When sharp bends are made in passing through bulkheads the lead covering is often cracked, and when moisture enters under the lead it seldom dries out. But the most serious objection is that there seems to be no practical means of making a water-tight joint at the junction and outlet boxes. Oakum covered with compound or molten lead will crack and leak with the working of the ship.

Ordinary duplex, double-braid, 1/64-in. rubber-insulated wire in rigid steel conduit gives fine results, but the splices should be carefully made and painted thoroughly with a waterproof, insulating paint, and more space should be allowed between the bare contact points and the metal boxes in the water-tight switches and receptacles.

The glass globes on the steam-tight lamp receptacles should be made clear and fully transparent, since this would eliminate the common practice of removing the globes to get better

Deck Bushing and Conduit Exposed to Sea Water.

light. Where a clear globe would give objectionable glare, the lamp should be large enough to give the illumination needed without tempting the men to remove the globe.

A moistureproof asbestos-insulated wire should be used that will stand up under the extremes of high temperatures and excessive moisture in the boiler rooms.

It would be a great advantage to have a separate steam line direct from the boilers with an independent atmospheric exhaust to be used as an auxiliary on at least one of the generating sets in order to insure having light on the ship when repairs are being made on the main or auxiliary steam and exhaust lines.

Turbine-driven generating sets operate very satisfactorily and have the advantage of being able to use superheated steam and are very efficient when they exhaust into the high vacuum of the main condenser.

A two or three-phase system should be developed for marine work in order to use the great water-resisting qualities of certain types of alternating-current motors, especially the squirrel-cage induction type.

If motors were used on the deck winches, capstans and pumps, a great saving of space would be gained, both in the apparatus and through the elimination of the steam piping; besides the resistance losses would be much less than the losses from condensation, especially on the long lines of uncovered steam pipes running to the deck winches.

The pumps and motors could be reduced to the least number of types within practical limits; this would be a great advantage in the interchangeability of spare parts.

Motor-driven centrifugal pumps with their uniform flow and the ease with which the discharge is controlled would eliminate the disastrous hammer effects of the reciprocating pumps, especially on the boiler feed and the sanitary service.

An ammeter could readily be connected in each motor circuit which would indicate the performance of the pump at all times.

A centrifugal pump furnishing fuel oil to the burners would give an economical flame without the flicker.

The deck winches could easily be motor-driven with portable controllers; by placing the operator on the hatch combing, he could handle the loads without the expense of a signal man.

It is necessary to bear in mind at all times in designing and installing electrical apparatus for ships that the elimination, as far as practicable, of exposed contacts either stationary or moving is of the greatest importance, especially on the apparatus in which interruption of operation would endanger the safety of the ship.

An electrical indicating and recording revolution counter would have many advantages over the mechanical or pneumatic counters. It would indicate and record the revolutions per minute either ahead or astern at all times and record the revolutions per watch or per day or any intervening period. The telegraph signal bells from the bridge to the engine room could be recorded on the same sheet. This information would be invaluable in case of collision and it would be a permanent record of efficiency of the engineers in the handling of engines. The bridge and the chief engineer would be informed at all times of the performances of the engines.

Some American manufacturer should put on the market a thermometer that will meet the requirements of ship's engine and boiler rooms. For the proper operation of a ship it is necessary to have thermometers for the fuel oil to the burners, settling tanks, stacks, main superheated steam, boiler room, engine room, sea water, discharge from condenser, steam below atmospheric pressure, hot well, feed-water heater, lubricating oil to and from bearings on the turbines and gears and many other places. The problem now with the present type of thermometer is to read it. What is wanted is a small electric light contained in the thermometer case and a scale that can be read at any angle at a distance of from 3 to 6 ft. The well must be separate from the thermometer and the electric light connected by a short flexible cable to a water-tight plug and fuse box. Preferably the thermometers should have the Fahrenheit scale, because this scale has a smaller range between the numbers than the centigrade.

Electricity in the merchant marine has been neglected. If more thought were expended in this field it would help to keep on the seven seas the

American flag and all that it stands for in the way of better living conditions for the sailor. We must have the sailor to run the ships. At its best, life at sea is a hard game. Much talk has been expended about the high wages of the American sailor, but the cost of wages, food and other items for the manning of the ship, both for officers and men, is less than 2% of the operating cost.

The cost of operating American ships can be readily reduced by the more extensive use of electricity.

OPPORTUNITIES OF CONTRACTORS IN FACTORY LIGHTING.

With a Little Effort Excellent Business Can Be Developed in Rehabilitating the Lighting and Selling Lamps.

It has long been believed by close observers of the electric lighting field that the electrical contractor occupies a peculiarly favored position in the opportunities that are available for business in modernizing lighting installations. This field includes the lighting of practically all buildings, except large industrial plants, central stations, hotels, office buildings, institutions, etc., that have their own force of electricians. Definite verification of this belief has been furnished by the survey of industrial lighting conditions recently made for the National Lamp Works and which is reported on pages 180-183 of this issue. Without reviewing the conditions that led to the making of this survey, which were discussed in our last issue, it will serve here to call special attention of electrical contractors to at least a few of the facts brought out.

About 14% of factories are found to be either dissatisfied with their present lighting, eager to improve it, or at least doubtful as to its satisfactoriness. Thus in practically one out of every seven factories there is required very little argument to convince the owner or manager that the lighting should be modernized. Moreover, in fully 30% of factories it was admitted that the lighting had not been changed within five years, that is, the installation was manifestly not up to date as regards use of gas-filled Mazda lamps and modern types of reflectors. This 30% is an average figure for plants in all localities; in small and medium-sized towns it runs from 34 to nearly 40% and applies especially to small plants that have no electrical departments of their own.

In planning changes in the lighting the local contractor-dealer is consulted in some 40% of the plants, on the average, while in some states this figure rises to nearly 50%. As regards the actual installation of the changes, the contractor-dealer takes care of this in about 59% of the plants and the central station in only 2%, the plant electrician (in the larger plants) handling the matter in about 42% of the factories.

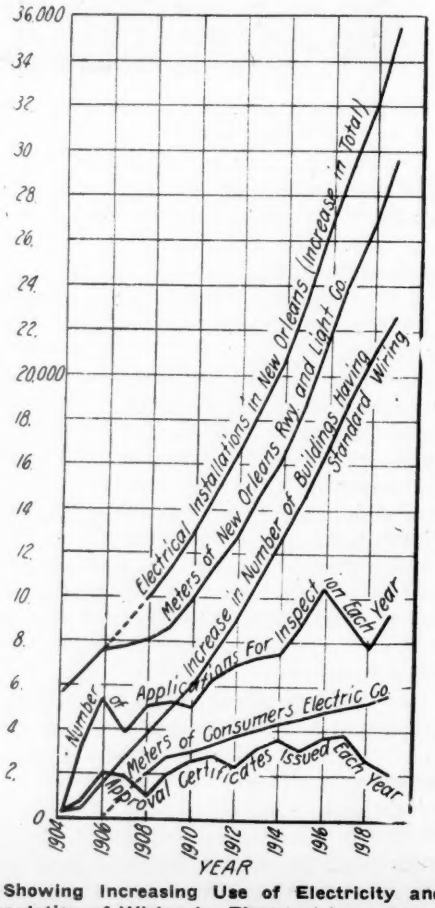
As to the sale of lamps, the local contractor-dealer also has a strong hold on the factory business. In over one-third of the plants he handles this exclusively.

There is absolute certainty that with a moderate amount of aggressive cultivation the industrial lighting field can readily be developed very decidedly and greatly beyond the present scope of this business. The fact is that in the case of the countless number of smaller factories the contractor-dealer is not only the favored party to plan and install modern lighting, but almost the only one that can effectively develop this business.

To do this intelligently, however, he should study the requirements of factory lighting, learn how it should be installed and what are the best methods of going after the business. Several manufacturers of lamps and lighting equipment have issued special pamphlets for aiding the contractor in this work. Notable in this line are a number of publications by the National Lamp Works, of Cleveland, O., among these being "How to Plan the Lighting Installation for a Factory," which gives very valuable help in designing the layout on modern lines.

IMPROVEMENT IN ELECTRICAL CONDITIONS IN NEW ORLEANS.

The accompanying curves tell very effectively the story of the steady improvement in electrical conditions in New Orleans, La. They show not only the increase in the use of electricity in the city, but the growth of electrical inspection and its influence in steadily increasing the percentage of buildings having standard approved wiring. Electrical inspection was begun in the city in 1904 by the fire underwriter interests and for many years was conducted exclusively by the Louisiana Fire Prevention Bureau, to whom we are indebted for this curve sheet. The Electrical Department of the Bureau has been systematically trying to raise the standards of electrical construction employed in the city and has succeeded very well.



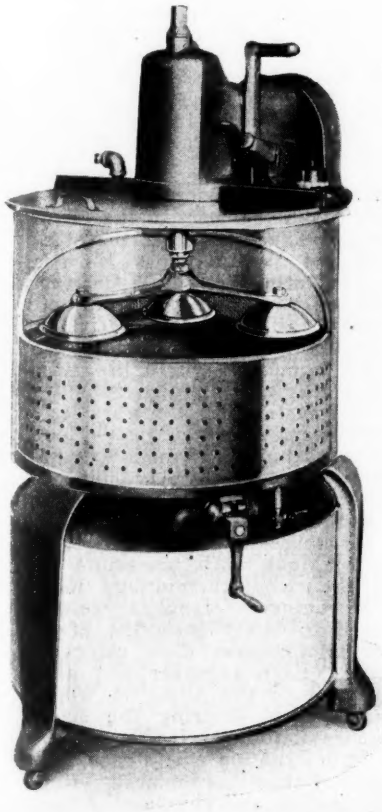
Curves Showing Increasing Use of Electricity and the Regulation of Wiring by Electrical Inspection.

New Appliances

Washing Machine Using Centrifugal Action for Drying— Motor-Driven Churn — Extension for Lengthening Poles

Klymax Washers Embody Unique Drying Features.

The Klymax washing machine, a washer of the vacuum suction type, is being introduced by John Negrescou, president of the Home Utilities Co., 17 North State street, Chicago. The machine is metal throughout and all parts coming in contact with the clothing are either copper, brass or aluminum. The washing is done in a circular drum by the up and down motion of three vacuum cups on the ends of arms. The vacuum cups force the soapy water through the clothes on the down stroke and on the up stroke suck it back. Power is furnished by a ¼-hp. electric motor protected against overloading by an automatic adjustment, making it impossible to burn out either motor or fuse. A belt is the means of transmitting power and is claimed to be far superior to gear or shaft. All machines come without a ringer, centrifugal motion being the means of drying, and are equipped with a special heater for boiling and sterilizing. All moving parts are enclosed and the whole machine presents a neat and compact appearance.

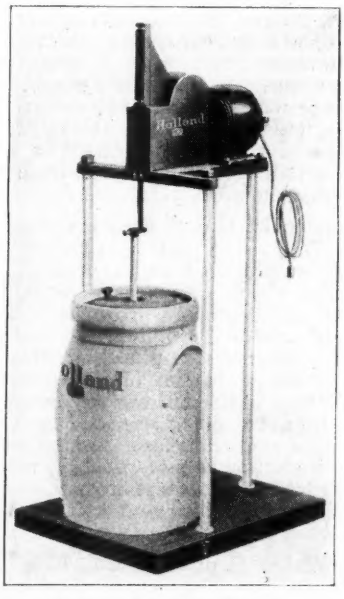


Phantom View of Washer, Showing Centrifugal Action Wringer Device.

New Electric Churn Has Many Desirable Features.

The Holland Manufacturing Co., 129 North Wells street, Chicago, has presented a new electric butter-maker to the electrical field. The whole appliance weighs only 60 lbs and features enclosed gears, minimum current consumption and the old and practical method of the stick and dash type churn.

The base of the churn is stained wood, supporting three iron uprights which in turn support the driving mechanism mounted on a T-shaped base. Suitably located on this base are three pins which keep the earthenware container in proper place. The container is a double-glazed stone



Holland Electric Churn.

jar with suitable side handles, making it easily handled and cleaned. It has a close-fitting top, rendering it impossible for cream to splash out. The dashrod is of aluminum, which cannot rust or corrode and is easily kept clean. The dasher blades are of maple, forming a cross, with an opening in each section which assists in working the cream. In the driving mechanism the base plate and casing are of iron, cast in one piece, with one side easily removable for access to gears. The gear mechanism is the simplest possible and is directly connected to a 1-12 H. P. motor of the latest design.

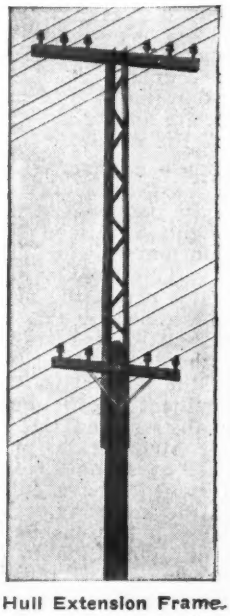
This machine is designed for home use and will churn from one-half to three and one-half gallons at a time. It can be equipped with motor, either for 110 volts alternating current or direct current, or 32 volt direct current. Suitable conducting wires are furnished which can be attached to any ordinary lamp socket or electric plug.

Extension for Making Short Poles Long.

S. W. Hull & Co., 3729 Prospect avenue, Cleveland, O., has placed on the market an extension frame for increasing the height of transmission line poles. This piece of equipment is a practical extension frame that is being taken advantage of by many transmission companies throughout the country.

The principle is simple, yet remarkably efficient and economical. Two main compression members of steel angles, reinforced by steel lace bars, comprise a frame. The frame is fastened to the top of the pole by three through bolts. A special feature is the great combination of cross-arm heights possible. A cross-arm can be bolted at the intersection of every lace bar.

S. W. Hull & Co. report that one holding company has standardized on its extension frame and that this company recently placed an order for sufficient extension frames to care for the repair work of transmission lines emanating from 30 different power plants. In another instance recently, a New England utility was enabled to



Hull Extension Frame.

use an existing pole line carrying *low*-voltage circuits by stringing a high voltage line above the existing circuits. This necessitated using extensions, but by so doing saved more than $100 per mile of line.

Trade Activities

Rauch & Lang Factory to Locate at Chicopee Falls—B. & K. Manufacturing Engages Larger Quarters—Literature

McIntire Corp., 35-37 Vesey street, Newark, N. J., is making distribution of a new circular descriptive of McIntire sleeves for overhead and underground work. These connectors, which are claimed to eliminate the trouble due from improper conductivity, have been used successfully for many years by the largest telephone, telegraph and electric light and power companies for splicing copper and iron wire.

Beardslee Chandelier Manufacturing Co., Chicago, has leased a new factory, comprising two floors and basement, at 115 South Jefferson street, which will be devoted entirely to the manufacture of the Denzar lighting unit. Steadily increasing orders for Denzars have necessitated larger manufacturing facilities. The additional space will enable the company to triple last year's output and make prompt deliveries. The office remains at 216 South Jefferson street.

B. & K. Manufacturing Co., manufacturer of portable lamps, on Feb. 1 will move its plant from New Britain, Conn., to 62 Franklin street, New Haven, Conn. The business of the company has increased to such an extent that it has been compelled to triple its last year's production, and with the increased facilities afforded by the new quarters, it will be in a position to render its customers added service in 1920. Since the B. & K. company has engaged in the manufacture of modern portable lamps, its business has become so great that it is today recognized as one of the leaders in this line of endeavor, and its products are among the most popular now on the market.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., recently issued a pamphlet in which are very thoroughly explained "Westinghouse Opportunities for Technical Graduates." This booklet describes, in considerable detail, the plan which has been developed by this company for the training of the graduates of technical schools at all of its various works. In the booklet is included a list of prominent Westinghouse men who originally entered the company as graduate students, as well as a complete list of schools from which over 5000 students have entered the employ of the company. Copies of the booklet will be sent to any one interested on application to the educational department of the company at East Pittsburgh.

Nelson Blower & Furnace Co., Boston, Mass., which is undergoing reorganization, will specialize on Galusha gas producers for industrial plants, by which means a dry, combustible gas, suitable for power or fuel purposes is obtained directly from coal or other fuels. This producer has been in commercial use since 1907 and was developed by a technically trained engineer, having 20 years' experience in gas engineering and was originally designed to meet the extreme conditions of the marine field. The construction of this device and its advantages are clearly set forth in an illustrated bulletin, which the company has issued. Special emphasis is laid on the cheap fuel required, its flexibility, cleanliness, safety, reliability, compactness and simplicity of operation. Tables of comparative power costs with various types of engines, characteristics of various methods of obtaining power, outline dimensions as well as views of typical installations are included in the publication.

E. B. Badger & Sons Co., 75 Pearl street, Boston, Mass., manufacturer of self-equalizing expansion joints for steam and water pipe systems and of air washers and cooling systems, has opened a district office at 616 South Michigan avenue, Chicago, in charge of H. E. Wheeler. The Chicago territory will be served from the new district office.

Condensite Co. of America, Bloomfield, N. J., has issued an instructive little pamphlet of 16 pages on Condensite, which will be of special interest to buyers and prospective buyers of molded Condensite, and to their designing engineers. It discusses the properties of this product, how it is molded, how to design it and how to specify it and will do much to acquaint the designing engineer with the plastic molding art as applied to the fabrication of Condensite, its possibilities and its limitations.

Northern Equipment Co., Erie, Pa., has published a 24-page booklet which has for its title "Saving Fuel Automatically and Scientifically in the Boiler Room." It is based upon matter that was prepared for the United States Fuel Administration during the war. In the preface of the booklet the manufacturer says, "When the war ended we thought we had done our duty, and that the fuel situation would ease up a bit. However, we find the fuel problem now becoming serious. Prices will not come down because wages will evidently stay up or will go higher." The booklet thoroughly compares hand and mechanical feeding with mechanical regulation, as performed by the Copes regulator. It shows in a convincing way what is to be desired in the way of scientific boiler feed regulation. Many charts and diagrams are shown to emphasize the value of scientific control. Editorials from publications and articles and letters by prominent engineers are reproduced. Finally, the names of many prominent owners of power plants using Copes regulators are given.

Anylite Electric Co., manufacturer of electrical appliances and controllers, Fort Wayne, Ind., is sending out a new illustrated circular on its electric light dimmer. The company has recently introduced an interesting feature in the design of its light controller. This is the "Uno thread," which since its adoption by leading socket makers renders the "Uno" shader holder a standard fixture, whose attractive appearance and practical utility are receiving general recognition. The Anylite Co. is also making a specialty of its 32-volt. 40-watt dimmer for farm-lighting plants.

General Chemical Co., New York City, has entered into a contract with the J. G. White Engineering Corp., covering the future designing, engineering and construction work incident to improvements and extensions to existing manufacturing plants, buildings and other property and in connection with any new projects or developments which may be undertaken from time to time. Under this arrangement, the J. G. White Engineering Corp. will handle its engineering and construction work. Two initial pieces of work which are to be carried out immediately under the new arrangement are the construction of a large warehouse at Pittsburgh and improvements to the company's Delaware works near Marcus Hook, Pa.

Westinghouse Company Makes Notable Transfer of Engineers.—Seventy-five engineers from the machine works of Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., and their families were moved recently to Lester, within 10 minutes' walk of the South Philadelphia works of the company, where the machine works engineering department has been transferred. Contrary to the old system of every man's looking out for a home to which to take his family, the company has built a large number of houses which are rented to employes. Photographs were taken of the houses and sent to East Pittsburgh, along with blueprints showing their construction and location. The engineers' families were permitted to select from the drawings and photographs their choice of a home. Each engineer was given a blueprint of the house in which he was to live, showing the size and number of rooms. He then made out a tag designating where each piece of furniture should be replaced. The packing, crating and shipping of the furniture was accomplished without any physical exertion on the part of any one of the families, for the Westing-

house company engaged five of the leading transfer and storage companies of Pittsburgh to go into their homes, pack, crate, and deliver the furniture to cars. The work was done in a record-breaking time. It required only eight days to complete the packing of the household effects of the 75 families. When the furniture arrived in Philadelphia, it was unloaded and hauled in trucks to the new homes and unpacked. Carpets were laid and the goods placed in rooms, in accordance with the requests of the family. It required 40 cars to complete the shipment of furniture and automobiles. In the meantime, the employes continued their work at the East Pittsburgh plant, living with friends and in hotels. The engineers and their families left for Philadelphia on Wednesday evening, Jan. 14, on a special train consisting of nine Pullmans. When they arrived in Philadelphia on Thursday morning, they were given their breakfast at the Broad Street station, Philadelphia, after which special street cars carried them to the South Philadelphia works for an inspection of the plant.

Edison Lamp Works of the General Electric Co., Harrison, N. J., has issued its calendar for 1920. This calendar is the reproduction of a painting made by Maxfield Parrish especially for the Edison Lamp Works of the General Electric Co., and is entitled "Prometheus." The theme taken, of course, from the Greek legend, is that out of chaos came light and order in the world through the work of Prometheus and Epimetheus, the former of whom is supposed to have undertaken the work; the latter to have supervised it. In the calendar, Maxfield Parrish has represented Prometheus returning earthward with the lighted torch after leaving the chariot of the sun. Through the ages the light used by man has changed from a light in a shell, a skull, or bit of clay and metal containers, filled with animal oil, to tallow candles, gaseous vapors and finally electricity. The calendar is a magnificent piece of art. The theme is eloquently applicable and is superbly depicted by Maxfield Parrish.

Electric Furnace Co., Alliance, O., added a number of installations during the last quarter of 1919, which are of special interest on account of the new type of equipment involved and the special alloys which are to be melted in these furnaces. These are as follows: The Standard Sanitary Manufacturing Co., Louisville, Ky., has just installed its fifth Baily electric furnace for melting yellow brass; McRae Roberts Co., Detroit, Mich., third Baily furnace; Nolte Brass Co., Springfield, O., second Baily furnace; White & Bros., Philadelphia, Pa., one 105-kw. furnace, 1500-lb. capacity; Akron Bronze & Aluminum Co., Akron, O., one 105-kw. furnace, melting red and yellow brass; Union Brass & Metals Co., St. Paul, Minn., one 105-kw. furnace for melting red and yellow brass; American Hardware Co., New Britain, Conn., one 105-kw. furnace, melting brass; Roberts Brass Works, Detroit, Mich., three Baily furnaces each of 1500-lb. capacity; Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., a 50-kw. furnace of 500-lb. hearth capacity; Wasson Piston Ring Co., Plainfield, N. J., has placed an order for a 500-lb. furnace for melting gray iron; Kayline Co., Cleveland, O., one 50-kw. furnace with 500-lb. hearth capacity, for melting yellow brass; Mitsui & Co., of Japan, a 105-kw. nose-tilting furnace of one-ton capacity, together with a special motor-operated casting table, so designed that metal may be poured directly into the moulds. Similar equipment, but with three casting tables, has been purchased by the Parrish Pool Co., Cleveland, O.; West Virginia Metals Corp., two Baily units, each of 1500-lb. to one-ton capacity. Both will be nose-tilting furnaces, and Lamson & Sessions, Cleveland, O., one 40-kw. hearth-type furnace for heat-treating bolts in their factory.

Brown Instrument Co., Philadelphia, Pa., is making distribution of catalog No. 12 on Brown pyrometers which is perhaps the most comprehensive treatise on the subject of pyrometry covered by a catalog. This is a very handsome book of 88 pages, 8x 10½ ins., presenting the subject in practical form and in a manner easily understood by even the nontechnical reader. It illustrates and describes at considerable length Brown pyrometers and their construction, their use for heat treating, blast furnaces, gas plants, galvanizing and tinning, in chemical plants and oil refineries and many other plants where instruments for measuring high temperatures are employed. The catalog also gives valuable information regarding pressure gauges, draft gauges, tachometers, time and operation recorders and other instruments of the Brown line. The book is elaborately illustrated with some 150 halftones and diagrams of the various instruments, reproductions of chart records from the various pyrometers, views of typical installations, etc.

General Electric Co., Schenectady N. Y., recently issued bulletin No. 41309, which has for its subject "Synchronous Motors," and contains considerable data on the application of synchronous motor drive to various classes of industry. It describes in detail the various parts entering into the construction of this type of motor and clearly sets forth its advantages over the induction motor, the recognition of which has resulted in an ever-increasing demand for its application. These consist in better efficiency and power factor, dependability of operation and starting ability, yet owing to certain starting torque or speed requirements, there are three classes of service for which the normally designed synchronous motor is not recommended for direct drive. These are loads requiring the motor to start under full load; loads requiring variable speed and loads requiring frequent reversals in the direction of rotation or requiring frequent starting and stopping. For many years the General Electric Co. has studied the synchronous motor problem with particular reference to its application to various forms of industrial drive, and has built and successfully applied the synchronous motor for driving the following: Motor generator sets, frequency converters, air compressors, ammonia compressors, pulp grinders, Jordans, stone crushers, centrifugal pumps, plunger pumps, screw pumps, blowers, fans, conveyors, tube mills, flour mills, cement mills, rubber mills, line shafting, steel and copper rolls, and for operating as synchronous condensers. The bulletin is profusely illustrated with charts, torque curves, diagrams and views of typical installations.

Cutler-Hammer Manufacturing Co., Milwaukee and New York, has printed a new four-page descriptive leaflet, 8½x11 ins., designated as Publication 806, which has for its title "Insuring Full Return on Truck Investments." This leaflet describes and illustrates the new C-H automatic sectional type of battery charging equipment for charging battery-driven vehicles, trucks and locomotives. A separate section is shown in detail and an installation of a six-section equipment indicates the method of arranging in complete panels. How this charging equipment automatically cares for the charge, tapers the rate, and terminates the charge, are discussed at some length. The Universal unit type section is also included and typical fleets of electrics charged by C-H apparatus are photographically reproduced.

Rauch & Lang Factory Moved to Chicopee Falls.—Announcement is made of the removal of the Rauch & Lang electric factory of the Baker R. & L. Co., Cleveland, O., to Chicopee Falls, Mass., in order to expedite production to meet the growing demand for its vehicles. The critical shortage of skilled labor in Cleveland, resulting from the expansion in many lines of industry, and the increasing difficulties there in obtaining materials on account of the abnormal demand, has made it impossible to get out production without serious delays in filling orders. Moreover, due to the expansion of the various lines of the Baker R. & L. Co., the existing plants were not adequate to meet present-day conditions, and so it was found necessary to segregate the electric car end of the business to manufacture in larger volume. The new factory location, which is a suburb of Springfield, was chosen on account of the better labor and material conditions. Chicopee Falls is in the heart of the mill district of New England, where raw and finished material may be secured with less delay than near the automobile center of the Middle West, and affords excellent shipping facilities, both for domestic and export purposes.

The Rauch & Lang factory, when completed, will occupy a large part of the 18-acre tract purchased especially for the purpose. The new company has been chartered and will be known as Rauch & Lang, Inc. No announcement has yet been made of the complete personnel of the new organization, but it is understood that men closely identified with Rauch & Lang in the past will head the new company. Harry H. Doering, one of the pioneer electric car men of the country, formerly sales manager of the Ohio Electric Car Co. and for the past seven years with the Rauch & Lang organization as sales manager and in other executive capacities, is vice-president and general sales manager of the new company.

Current News

News of Construction Activities and Business Opportunities

EASTERN STATES.

Lunenberg, Vt.—Fitzdale Paper Mills, Fitzdale, is having preliminary plans prepared for a one-story, reinforced concrete and steel power house, to cost about $1,000,000.

Springfield, Mass.—Cheney Bigelow Wire Works has had plans prepared for the construction of a new two-story brick addition to its plant, about 71x195 ft., and 48x271 ft. A. J. Tucker is president.

Springfield, Mass.—Plans have been completed by the Gilbert & Barker Manufacturing Co. for the construction of the proposed addition to its power plant to be used for general factory operation.

Ansonia, Conn.—Ansonia & Co., manufacturer of elastic webbing, etc., is considering plans for the construction of a local factory and power plant, estimated to cost $50,000.

Hartford, Conn.—Hartford Battery Manufacturing Co. has filed notice with the Secretary of State of an increase in its capital from $250,000 to $350,000, and the issuance of additional stock, to provide for proposed business expansion.

Hartford, Conn.—Hart & Hegeman Manufacturing Co. plans the erection of a four or five-story addition to its plant, 52x187 ft.

Brockport, N. Y.—Great Atlantic & Pacific Tea Co. is planning for the enlargement of the power plant at the works of the Dailey, Udell Canning Co., recently acquired, for increased operations.

Brooklyn, N. Y.—In connection with the erection of a number of additions to its plant, the American Safety Razor Corp., 303 Jay street, will build a one-story boiler plant on Lawrence street, for general works service.

Buffalo, N. Y.—City council has authorized Corporation Counsel Rann to draw up a charter amendment providing for the construction of the proposed new municipal hydroelectric power plant.

Buffalo, N. Y.—City council is considering the presentation of an ordinance providing for the electrification of all steam railroads in the city, and the installation of underground conduit systems to replace the present overhead wires.

Hamlin, N. Y.—Western New York Utilities Co. has been granted a franchise by the Town Council for permission to run its electric lines through the towns of Hamlin and Kendall. It is understood that plans are being perfected for the installation of new electric street-lighting systems at Hamlin, Kendall, and Morton.

New York, N. Y.—Sugar Products Co., 16 Exchange place, has had plans prepared for the construction of a new one-story brick boiler plant at its works on Metropolitan avenue, Brooklyn. The structure will be about 25x33 ft.

New York, N. Y.—Western Electric Co., 195 Broadway, is having plans prepared for the construction of a new eight-story, reinforced concrete warehouse building to be located on the block bounded by Hudson, West Houston, Greenwich, and Clarkson streets. The structure will provide about 40,000 sq. ft. of floor space.

New York, N. Y.—U. S. Battery Co., 157 West 54th street, has had plans prepared for the construction of a new four-story brick and steel building, about 72x100 ft., at 161-67 West 64th street. The structure is estimated to cost $100,000. H. B. Shontz Co., 157 West 54th street, is in charge of the work.

New York, N. Y.—In connection with the establishment of the proposed new freight terminal at Weehawken, N. J., by the Cunard Steamship Corp., it is planned to construct a total of eight concrete and steel piers about 1000 ft. long, of double-deck type, which will be equipped with complete modern machinery for all features of operation. Considerable electrical equipment will also be required. The project is estimated to cost in excess of $20,000,000.

New York, N. Y.—In connection with the construction of the proposed candy manufacturing plant of the Advance Novelty Candy Manufacturing Co., 511 East 72nd street, to be located at Willow avenue and 138th street, considerable electrical and mechanical equipment will be required. The structure will be six-story, reinforced concrete, about 125x200 ft., and is estimated to cost $500,000.

New York, N. Y.—New York Edison Co., Irving place and 15th street, has completed plans for the construction of a new transformer and storage battery building at 421-23 East Sixth street. The company has recently been awarded a contract for furnishing electric service for the operation of the 20-story structure on Seventh avenue from 28th to 29th streets, the installation to comprise a total of 6000 lamps, as well as an installation of 1560 hp. will also be supplied for two sidewalk lifts, two house pumping units, sprinkler system, ventilating fans and compressor.

Niagara Falls, N. Y.—Niagara Falls Power Co. has recently completed a new unit to its hydroelectric power plant, bringing the total capacity up to 387,000 hp. It is said that the company is considering plans for further expansion, to increase this to a total of 450,000 hp.

Rochester, N. Y.—Large quantities of electrical and mechanical equipment will be required in connection with the construction of the proposed municipal garbage disposal plant, bids for which have been taken. The project is estimated to involve an expenditure of about $650,000.

Rochester, N. Y.—Rochester Gas & Electric Corp. is arranging plans for largely increased operations at its local plant, the work to include the erection of additions to present stations and the installation of new equipment.

Syracuse, N. Y.—In connection with the proposed 1920 construction plans of the H. H. Franklin Co., 302 South Geddes street, arrangements have been made for the construction of a large new power and heating plant, to cost approximately $200,000. The expansion program includes the erection of additions to provide about 500,000 sq. ft. of additional manufacturing area; a new seven-story structure to cost $700,000, as well as the installation of complete equipment for manufacture.

Syracuse, N. Y.—Syracuse Lighting Co. filed application with the Public Service Commission for permission to issue notes for $500,000, the proceeds to be used to cover, in part, proposed extensions and improvements in the municipal electric light and power plant. The proposed work includes the installation of additional equipment at the Solvay substation, estimated to cost $141,440; equipment at the Fayette Street substation, $143,850; improvements in the Fulton Street steam station, $45,630; installation of cable in subways, Solvay to Fayette street, and from Fayette to Fulton streets, $75,000; meter room testing equipment; miscellaneous improvements in station and distribution system, $18,000; extensions in street lighting and general distribution system, including meters, transformers, etc., $120,000. Improvements will also be made in the municipal gas plant, including the installation of new purification apparatus, to cost about $25,000; as well as additional condensing facilities, estimated at $10,000.

Newark, N. J.—P. N. G. Electric Co. has filed notice of organization to operate at 59 Court street for the production of electric fixtures, etc. Alfred H. Nelson, Fred M. Gosch, and T. President head the company.

Newark, N. J.—In connection with the proposed construction of the group of five factory buildings by the Industrial Factory Sites Corp., plans are being arranged for the installation of individual lighting systems in the structures, and the construction of a central heating plant.

Newark, N. J.—Miniature Incandescent Lamp Corp., 95 Eighth avenue,

has completed negotiations for the purchase of the three-story brick factory building at Eighth avenue and High street, to be used for increased operations. The company is planning for the installation of new equipment in the structure, which will be known as Plant No. 2.

Perth Amboy, N. J.—Plans are under consideration by the city council for the installation of a new "white way" electric street lighting system to extend on Madison avenue from Jefferson to Market street.

Phillipsburg, N. J.—Plans are under consideration by the town council for extensions and improvements in the electric street lighting system. Power for operation is furnished by the Pennsylvania Utilities Co.

Succasunna, N. J.—In arranging the annual budget for 1920, the town council has provided an appropriation of $3500 for the operation of the electric street lighting system.

Trenton, N. J.—Plans are under consideration by the city commissioners for improvements in the electric street-lighting system, providing for the installation of a "white way" to replace the present system of arc lamps. The work will cost about $38,000.

Trenton, N. J.—Star Porcelain Co., manufacturer of electrical porcelain specialties, is planning a two-story addition, 34x68 ft.

Allentown, Pa. — Lehigh Valley Light & Power Co., formerly known as the Lehigh Navigation Electric Co., is making rapid progress with the proposed expansion plans. The work includes the construction of a new high-voltage transmission line from the Siegfried substation, and the installation of a new 10,000-kw. Westinghouse turbogenerator in the Front street power plant of the company, which will increase the capacity of this station to about 30,000 kw. Work is progressing rapidly on the construction of the transmission line, which will include a total of about 125 steel and concrete towers, the Phoenix Utilities Co. being the contractor. The entire expansion is estimated to cost $150,000.

Bloomsburg, Pa.—Magee Carpet Co. is considering plans for the construction of a new one-story brick pumping plant at its works, about 24x24 ft.

Blossburg, Pa.—Board of Managers of the Blossburg Hospital is having plans prepared for the construction of a new one-story brick stone and concrete power house and laundry building at the institution.

Harrisburg, Pa.—City council has passed an ordinance providing for the installation of new lighting units of increased power for the street-lighting system.

Harrisburg, Pa.—Postal Telegraph Co. has recently filed with the Public Service Commission application for permission to place underground its service wires from the main headquarters in North Third street to Walnut street to connect with a duct line through Capitol Park.

Johnstown, Pa.—In connection with the 1920 construction program of the Cambria Steel Co., plans are being arranged for the construction of two new central power plants, to cost approximately $2,000,000. The work includes the installation of 12,000 hp. in boilers and superheaters, 8000 of which will be utilized at the Franklin works of the company, and the other 4000 hp. at the Cambria works. The entire expansion work of the company will involve an expenditure of close to $15,000,000.

Philadelphia, Pa.—The Department of Public Works has awarded a contract for extensive improvements in the municipal filter station at the water works plant, estimated to cost $376,467, in the Queen Lane district. It is understood that considerable electrical and mechanical equipment will be required.

Philadelphia, Pa.—William F. Read & Sons, Jackson and West 12th streets, have completed arrangements for the construction of the proposed one-story boiler plant addition to their works, about 23x61 ft., estimated to cost $7500.

Philadelphia, Pa.—Department of Public Works, C. W. Davis, chairman, has awarded a contract to Charles H. Dading, Bellevue Court building, for the construction of a new one-story engine and pumping station, about 63x78 ft., at the municipal plant on Lardners street.

Philadelphia, Pa. — Philadelphia Electric Co. has arranged for a note issue of $12,500,000, a portion of the proceeds of which, it is understood, will be used for proposed expansion, and the remainder for additional working capital. Joseph B. McCall is president.

Philadelphia, Pa.—George W. Blabon Co., in connection with extensive additions at its plant to provide for increased capacity, is having plans prepared to approximately double the present capacity of the company's central power station.

Pittsburgh, Pa.—Mount Oliver Ice Co. has recently completed negotiations for the purchase of property in Penn avenue, Mount Oliver Borough, to be used as a site for the construction of a new ice manufacturing plant to have an initial capacity of about 62 tons.

Scranton, Pa.—Klots Throwing Co., 25 Madison avenue, New York, has had plans prepared for the construction of a large new power plant addition to its local works. The structure will be two-story, brick and reinforced concrete, about 116x200 ft., and is estimated to cost $50,000. Lockwood, Greene & Co., 101 Park avenue, New York, are architects and engineers for the company.

Wernersville, Pa.—Board of Trustees of the Asylum for the Chronic Insane has inaugurated work on the construction of the proposed one-story boiler plant, about 50x60 ft., at the institution, estimated to cost $25,000. J. H. Greiner & Co., 826 Walnut street, Lebanon, are the contractors.

Baltimore, Md.—Board of awards has let contract to the Westinghouse Electric & Manufacturing Co. for a total of about 500 lighting standards for the street-lighting system, to cost about $13,000.

Baltimore, Md.—Delion Tire & Rubber Co., Trenton, N. J., is having preliminary plans prepared for the construction of a new brick factory and power plant to be located on Mount Royal avenue. Walter C. Price is president in charge of the proposed work

Centreville, Md.—Harbison Dairy Co., Philadelphia, has commenced the installation of a new 18-ton capacity refrigerating plant at its local plant.

Janelew, W. Va.—Burton M. Davisson contemplates the installation of water and electric light plants.

Edenton, N. C.—City has completed arrangements for improvements and alterations in the municipal electric plant, including the installation of new boiler equipment, turbogenerator set, transformers, etc. J. C. Martin is superintendent.

Raleigh, N. C.—Plans will be finished soon by James A. Salter, architect, State Building Commission of North Carolina, for a dormitory and dining-room for the North Carolina College for Women at Greensboro; two dormitories and a laundry building for the University of North Carolina; two dormitories and an extension building at the State A. and E. College, Raleigh; a dormitory and addition to the administration building at the East Carolina Teachers Training School, Greenville; and a building for the State Agricultural Department in Raleigh. All buildings will be fireproof, of brick reinforced concrete, and hollow tile blocks, and will be equipped with completely modern equipment. E. F. Dalton is chairman and J. H. Bridgers is secretary of the commission.

Gilbert, S. C.—Gilbert Electric Light & Power Co. is in the market for residential wiring apparatus, meters, switches, cutouts, insulated wire, etc. K. B. Price is engineer-manager.

Americus, Ga.—J. B. McCrary Co., of Atlanta, has been awarded contract for building municipal light and water plants to be installed.

Atlanta, Ga.—Georgia Railway & Power Co. will develop a 50,000-kw. hydroelectric project near Atlanta. Work will start on the site in the near future. The dam will be 150 ft. high and will contain an enormous quantity of concrete.

Folkston, Ga.—City has approved a bond issue for $10,000 to be used for the construction of a new municipal electric light and water system.

Chattahoochee, Fla.—Florida State Hospital, Home of Nurses, has awarded a contract for the construction of a large new brick and concrete power plant, about 60x120 ft., at the institution, estimated to cost $100,000. C. S. Hammatt, 215 Bay street, Jacksonville, is engineer.

NORTH CENTRAL STATES.

Dayton, O.—Burnett-Larsch Co., manufacturer of electric pumps and water systems, is considering the erection of a five-story building equal in size to its present structure.

New Philadelphia, O.—Several extensions will be made to the plant of the Wise-McClung Manufacturing Co. These include a two-story and basement building for assembling and

storage, machine shop, power plant, addition to motor and assembling building, polishing department and extension to its foundry.

Warren, O.—Heltzel Steel Form Co. will build an extension to its plant, doubling its present capacity, and install a 10-ton electric crane.

Columbus, Ind.—Lewellen Manufacturing Co. is in the market for machinery for its new plant, including 10 motors, 5 to 25 hp., 220 volts, three-phase. D. E. Lewellen is president.

Decatur, Ind.—Indiana Public Service Co. has approved issue of $75,000 electric light and power bonds.

Marion, Ind.—Indiana General Service Co. is making extensive improvements in its power plant. A new 6250-kw. Curtiss type turbine is being installed, also a new panelboard.

Newcastle, Ind.—City board of education will erect a $300,000 high school building.

Bloomington, Ill.—The Association of Commerce is interested in installing ornamental lights on East Worthington street.

Chicago, Ill.—Hub Electric Co. will erect a $40,000 plant, 105x144 ft.

Danville, Ill.—A regular boulevard lighting system is planned for the business district of Danville. The estimate of City Engineer Edwards is for a total of 200 of the ornamental lamps, with a lighting capacity of 12,000 cp.

Galena, Ill.—A new 5000-kw. steam turbine which the engineering department of the Byllesby Engineering & Management Corp. has been installing for the Interstate Light & Power Co. (Northern States Power Co.) at Galena, Ill., was recently placed in operation. The preliminary runs were entirely successful and the turbine is now carrying full load.

Graysville, Ill.—$10,000 bonds have been voted for municipal light and water system. Address city clerk.

Mt. Vernon, Ill.—Ways and means for a "white way" lighting system are under consideration. Address David Miller.

Waukegan, Ill.—Warner Electric Co. has been awarded the contract for wiring and furnishing the fixtures for 30 new houses to be constructed by the Griess-Pfieger Tanning Co. The Warner Electric Co. has recently taken large quarters for display and work rooms.

Sauk City, Wis.—Sauk City Power Co. will build a transformer station and power line in Dunn township. Address general manager of the Sauk City Power Co.

Stanley, Wis.—The city has had plans prepared for waterworks and sewer extensions, to include 500-gal. motor-driven centrifugal pump.

Wausau, Wis.—Wisconsin Valley Electric Co. has announced that in spring it will build a dam at the foot of Bull Falls in the Wisconsin river that will eliminate the falls and double the amount of horsepower now generated.

Chesterfield, Minn.—Teal Light & Power Co. is contemplating the installation of a duplicate electric unit in its plant. Address D. T. Teal, president and manager.

Faribault, Minn.—A proposition to serve the village of Medford and furnish power for operation of a large gravel pit in that vicinity is receiving the attention of the Faribault division of the Northern States Power Co. Medford is about 10 miles south of Faribault.

Montevideo, Minn.—The city of Montevideo is installing an additional 75-hp. motor to provide capacity for the water pumping plant. Energy will be furnished by the Montevideo division of the Northern States Power Co.

Davenport, Ia.—Davenport Forge Co. has been organized by L. E. Baldwin and Fred Grant. A new foundry building will be erected.

Maquoketa, Ia.—Iowa Electric Co. is planning the extension of electric service in rural districts near Toronto, Ia.

Maquoketa, Ia.—The city of Maquoketa has sold its 5% municipal electric light bonds to the amount of $65,000. Taylor, Ewert & Co. of Chicago made the purchase by paying a premium of $131 on the $65,000. The lowest bid was $975 below the par value of the bonds, making the difference between the highest and the lowest $1106.

Sioux City, Ia.—City will control radio station at Grandview Park, two 60-ft. towers will be erected by Sioux City Radio Co., W. B. Nesterode, manager.

St. Louis, Mo.—National Lamp Division of the General Electric Co. is planning for the erection of a new plant at Union and Brown streets, to cost approximately $500,000, including equipment.

Smithfield, Neb.—$12,910 water and light bonds have been voted.

Madison, S. D.—On Feb. 9 bids will be received for municipal electric light plant. Plans are on file at Builders' Exchange, Minneapolis.

Minot, N. D.—A new bakery being constructed in Minot will have as part of its equipment an electric oven with a capacity of 20,000 loaves of bread daily. Electric energy will be furnished by the Northern States Power Co.

SOUTH CENTRAL STATES.

Louisville, Ky.—The Belknap Hardware & Manufacturing Co. will begin the erection of a modern steel and concrete warehouse soon at the corner of First and Main streets. The building will be 15 stories high and cost $1,750,000.

Thornton, Ky.—Elkhorn Collieries Co. is having plans prepared for the installation of considerable new electrical equipment at its local mining properties.

Birmingham, Ala.—Alabama Power Co. is perfecting plans for the extension of its transmission facilities in the vicinity of Gadsden. Work has been inaugurated on the installation of a new cable extending from the top of Shinbone Ridge, 200 ft. high, to the summit of Lookout Mountain, 700 ft. high, about one mile distant.

Gadsden, Ala.—Burnett Boiler Co., Thomasville, recently incorporated, is planning for the establishment of a local plant for the manufacture of boilers, etc. The works are estimated to cost $14,000.

Georgetown, Miss.—A. Behrens will organize a company to establish electric light and water systems, creamery and ice plants.

Broussard, La.—The city will construct an electric light system. Bonds to the amount of $8000 will be voted on Feb. 24. L. J. Morgant is mayor.

Ozark, Ark.—Equipment for the production of 2246 spindles per day will be installed by the Rainbow Manufacturing Co. It will be installed in a 168x80 ft. mill-construction building to be erected at a cost of $12,000. The machinery will cost $30,000 and will be electrically driven, the daily capacity to be 1200 lbs. of wrapping twine, rope, etc. W. M. Hunter is the architect and engineer.

Stalton, Tex.—Lewis H. Fuller, of Austin, has been granted a franchise for the installation and operation of an electric light and power plant.

Waco, Tex.—Plans have been completed for the erection of a three-story, 210x215 ft. and 210x200 ft. buildings for the Miller Cotton Mills. Its machinery will include an electric plant for 150-hp. electric drive. Lockwood, Greene & Co., Boston and Atlanta, are architects and engineers.

WESTERN STATES.

Butte, Mont.—Montana Power Co. has leased a power site on Beartooth National Forest, in the vicinity of Billings, Mont., where it is proposed to develop a minimum of 10,000 hp. on a stream having an average flow of 90 second ft., and where, by the construction of a dam, 1200-ft. head will be obtained.

Bingham, Mont.—$50,000 has been voted for light and water plant to be operated by engine using oil as fuel.

Paris, Ida.—The city has under consideration the installation of a "white way" system of street lighting on the principal business streets.

Levan, Utah.—The city is negotiating with the Fountain Green Light & Power Co. for the extension of its electric service to Levan.

Holbrook, Ariz.—City council is having plans and specifications prepared for the installation of a new electric light and power plant, for municipal service. Bonds to cover the cost of the proposed work will be issued. A. M. Nicholson is engineer.

Centralia, Wash.—President P. W. Kane of the Kane Pneumatic Shock Absorber Co., is formulating a plan for installation of a 500-kw. power plant on Fords prairie, west of here, same to furnish energy to the Kane factory.

Seattle, Wash.—City engineer presented plans for tunneling Renton Hill from Leschi Park to 22nd avenue and Jackson street and Third avenue from Stewart street to Jackson street for subways which would cost the city $7,436,350.

Seattle, Wash.—General Electric

Co. was awarded contract on a bid of $6655.18 for furnishing the city with oil switches for the use of the lighting department.

Seattle, Wash.—NePage, McKenny Co., electrical engineer, contractor and manufacturer, has been awarded contract for complete electrical equipment in Pantages theater at Memphis, Tenn., including border lights, stage lighting, foot lights, strip lights and other necessary lighting facilities incident to modern theater illumination The company has started electrical work in St. Joseph's hospital at Aberdeen, Wash. The job is to be complete, including light, power and nurse call system. Beezer Brothers, Seattle, are the architects for this hosiptal.

Seattle, Wash.—Board of Public Works approved recommendation of Superintendent of Lighting J. D. Ross for furnishing a 50-ton overhead traveling crane for use at the Cedar Falls power house extension of the city lighting plant, estimated cost, $6000.

Seattle, Wash.—Allis-Chalmers Manufacturing Co. has been awarded contract by the Board of Public Works of Seattle for furnishing four transformers for the lighting department at $30,500.

Seattle, Wash.—Mandic Construction Co. has been awarded contract by Board of Public Works for grading the Skagit river power site wagon road at $62,842.

Seattle, Wash.—City is to build 28 miles of railway from Rockport to and up to the Skagit river to Gorge Creek for the purpose of delivering the materials needed in construction of the Skagit river hydroelectric power project. Board of Public Works has authorized purchase of 2665 tons of 65-lb. rails from the Great Northern Railway at $45 per ton f. o. b. Rockport. The sum of $120,000 is to cover the rails alone. City is to get out the ties and necessary timber and railroad bed will be graded through to the dam.

Seattle, Wash.—In his report to the mayor, transmitted by that official to the city council, Superintendent of Lighting J. D. Ross asks for $1,750,000 for completion of Cedar Falls power plant to a capacity of 18,000 kw. He estimates cost of Cedar Falls plant at $3,500,946.66. The sealing of the new dam has cost to date $381,814.07. Completion of penstock and installation of new generator will add $600,000 to the cost of the plant.

Tacoma, Wash.—Allis-Chalmers Manufacturing Co., Seattle, recently sold to the St. Paul & Tacoma Lumber Co., Tacoma, five electric motors which will be used for operating the woodworking machinery in its new mill.

Dallas, Ore.—Dallas Machine & Locomotive Works, recently organized with a capital of $35,000, is arranging plans for the operation of a local plant for the manufacture and repair of motors, engines, locomotives, etc. Carl F. Geringer, R. L. Chapman, and W. G. Vassail head the company.

Salem, Ore.—Plans are being arranged by the Bend Water, Light & Power Co. for its proposed expansion program, to include the construction of two new power plants, hydroelectric type, one located on the Tumalo river, to develop about 5000 hp. and estimated to cost $230,000, and the other on a site now under consideration. Extensive other improvements and additions will be made in the company's plants and system to provide increased operations.

Portland, Ore.—Carman Manufacturing Co. plans to double its present factory by an addition, 80x150 ft., to cost about $23,000. New equipment will be installed.

Wasco, Ore.—Homer S. Wall has filed application with Percy A. Gupper, state engineer, for appropriation of 500 ft. of water from John Day river for the development of 600 hp. near Early, Ore. He will construct concrete head gate and canal 20 ft. wide and install turbine water wheel. Dam has been completed. Construction on remainder of work is to be started by April 1, 1920, approximate cost, $57,150.

Calexico, Cal.—Holton Power Co. is planning for the immediate construction of the proposed local reinforced concrete substation. Plans for the structure have been completed

Eureka, Cal.—A new paper pulp mill will locate in Eureka soon. Redwood bark will be utilized in the mill for making roofing paper by a new process in which the trees are barked by machinery and shredded in the woods.

Hermosa Beach, Cal.—Plans are under consideration by the local authorities for the installation of a new electric street-lighting system.

Los Angeles, Cal.—The Board of Public Service, Knickerbocker building, has taken bids for the furnishing of a total of 530 ft. of 1,250,000 cir. mil. standard-stranded single conductor cable; a quantity of single conductor wipe-joint potheads, and other equipment for municipal service. James P. Vroman, secretary.

Modesto, Cal.—In connection with the construction of the proposed two-story addition to the plant of the Borden's Condensed Milk Co. in North Modesto, considerable electrical and mechanical equipment will be required.

Ontario, Cal.—Edison Electric Appliance Co., Inc., is having plans prepared for the construction of a large new addition to its local plant, to provide for increased capacity. It is proposed to inaugurate active work at an early date on the new addition.

Richmond, Cal.—Pacific Insulating & Refrigerating Co. has inaugurated operations in its new local plant, recently purchased, to be devoted to the manufacture of insulated pipe and refrigeration apparatus for ship service. It is said that the company is arranging plans for the construction of an additional unit at its plant for increased operations.

Watts, Cal.—City council has approved plans and specifications for the installation of a new electric street-lighting system throughout the entire city. It is understood that the work will be inaugurated at an early date.

PROPOSALS

Water Works Equipment.—Bids will be received by L. S. Ward, mayor of Jacksonville, N. C., until Feb. 17, to construct a water works, requiring the following: 12,000 ft. cast and wrought-iron water mains, 60,000-gal. concrete reservoir, steam-electric generating and pumping equipment, etc. Plans, etc., may be secured from the Carolina Engineering Co., 412 Southern building, Wilmington, N. C.

Power Plant Equipment.—Bids will be received at the office of commissioner of light and water, Room 403, City Hall, Tacoma, Wash., on Feb. 3, for furnishing the necessary machinery, equipment and materials for a lighting feeder switchboard at the Nisqually power plant, 25th street substation. Bond for 25% of the bid is required, payment to be made in warrants.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Supplies (31,814)—An American firm having branches in Egypt and Greece desires to secure agencies for the sale in Levant of automobile tires, hardware, electrical supplies, knit goods, and general merchandise. Quotations should be given f. a. s. New York. Payment to be made in New York. References.

Electrical Materials (31,817)—A firm in Spain desires to secure agencies on commission for the sale of sulphate of ammonia, electrical materials, coal, tinplate, etc. Quotations should be given. c. i. f. Spanish port. Correspondence may be in English. Samples are requested. References.

Machinery (31,828)—A manufacturer in France desires to secure an agency for the sale of all kinds of machinery, such as steam engines, pumps, and machinery used in sugar plants. Correspondence may be in English.

Machinery (31,836)—A manufacturer in the Philippine Islands desires to get in touch with manufacturers of hand and power machinery for the manufacture of brick and tile, adapted to the use of small concerns. He particularly desires to hear from concerns west of the Rocky Mountains on account of freight rates to the Pacific coast. He requests that he be furnished prices and shipping weights of the articles specified.

Electric Light Plant (31,844)—An American firm with a branch office in the Orient desires to secure the agency for a complete electric lighting plant for Java. It is able to place orders immediately. References.

Personals

G. L. Washington to Represent Westinghouse in Cuba — N. C. Kingsbury, W. J. Warder and R. K. Sheppard Expire

E. L. West, Easton, Pa., has been re-elected president of the Reading Transit & Light Co., the Metropolitan Edison Co., the Oley Valley Railway Co., Reading & Hamburg Railway Co., Twelfth & Thirteenth Street Railway Co., Womelsdorf & Myerstown Railway Co.

Charles E. Sharpe, dealer and exporter, specializing in high-grade electrical and mechanical supplies, St. Louis, Mo., recently returned from a trade tour of Mexico, where he found business conditions much improved over last year. In commenting on the political situation in that country, Mr. Sharp said, "In all the time I was in Mexico I had not the slightest fear of being molested in any way whatever. The conditions where they are not perfectly normal are rapidly becoming so, and from the Mexican standpoint, I do not look forward to any political disturbance between the two countries. The Mexicans are gradually solving their problems in their own way, and I have great confidence in the future of the country." Mr. Sharp is a member of the Foreign Trade Bureau of the Chamber of Commerce, and a member of the board of trustees of the Mississippi Valley Trading & Navigation Co.

George L. Washington, of the negotiation division of the Westinghouse Electric International Co., has left East Pittsburgh, Pa., for Cuba, where he will be located as special salesman in the Havana office of the company. Mr. Washington attended the Alabama Polytechnic Institute of Auburn, Ala., from 1912 to 1916 and was graduated with a B. S. degree in electrical engineering. He entered the employ of the export department of the Westinghouse company in May, 1917, after completing the college graduate apprentice course. In September, 1917, he entered military service and was discharged in January, 1919, as first lieutenant of the 46th U. S. Infantry. Upon his return he was placed on order work in the International company, and in May was transferred to the negotiation division.

A. L. Perry, assistant credit manager of the Government department of the Western Electric Co., New York, is now assistant credit manager at the New York office. Mr. Perry entered the employ of the company in 1905 in the inventory department, and after serving in the billing and credit departments for a short time, he was made cashier at the Kansas City branch in 1906. Three years later he became chief clerk at St. Louis, and in December, 1910, came to Chicago with the same title. In 1918 he became assistant credit manager of the Government department, in which capacity he served until his recent promotion.

OBITUARY.

Nathan Corning Kingsbury, first vice-president of the American Telephone & Telegraph Co., died suddenly at his home in New York City Friday evening, Jan. 23, apparently from heart disease. He was at his office as usual during the day. Mr. Kingsbury was born in 1866 and was graduated from Oberlin College. He took up telephone work in 1907, becoming president of the Michigan State Telephone Co., and in 1911 became associated with the American Telephone & Telegraph Co., having considerable to do with both the general policies and public relations of the company. Mr. Kingsbury was an associate member of the American Institute of Electrical Engineers and a member of the Lotos Club of New York City. He is survived by a widow, formerly Miss Lillian B. Prescott of Duluth, and one daughter.

Walter J. Warder, Jr., electrical engineer of Roth Brothers & Co., Chicago, passed away Jan. 20 at the age of 41 years. Mr. Warder was born in Chicago in 1879. He received his early

Walter J. Warder, Jr.

education in the city schools and was graduated and received his degrees from the Lewis Institute. He started his career in the engineering field as a designer of motors for the Western Electric Co., whom he served for several years, and left the company to join Roth Brothers & Co., remaining with this organization for a number of years. He subsequently became connected with the engineering department of the Westinghouse Electric & Manufacturing Co. at Pittsburgh at a time when it was revising its line of power motors. Two years later he resigned to become assistant to the president of the Crocker-Wheeler Co. at Ampere, N. J., later becoming general works manager of the company. The death of his father left some property in Florida somewhat incumbered, and he was compelled to give up his electrical work to go to Tampa for a year and one-half, during which time he took over the management of the Tampa Steam Ways, a shipbuilding concern. When this work was completed Mr. Warder returned to Chicago and became affiliated with Roth Brothers & Co. as chief engineer. In this capacity he was responsible for a great many of the very remarkable and unique features of the machines which this company has produced during the past few years. About ten years ago Mr. Warder became associated with A. A. Pitt and R. I. Phillips in the Pitt Engineering Co., Chicago, holding a nominal amount of stock and serving in an advisory capacity for this concern. Mr. Warder was noted for his exceptional engineering capability. He had the true engineering insight of well-balanced imagination and power of logical analysis, which gave him ability to see his work in proper commercial use. He was a member of the American Institute of Electrical Engineers, Western Society of Engineers and the Electric Club. Mr. Warder was a man of exceptionally fine character and leaves a wide circle of friends and acquaintances all over the country.

Robert K. Sheppard, general sales manager of the Simplex Wire & Cable Co., Boston and Cambridge, died very suddenly Jan. 22 at his home in Newtonville, Mass. Although Mr. Sheppard had been in ill health since last summer, his condition was not thought serious. He was born at Boston in 1871 and was graduated from the Massachusetts Institute of Technology in 1895 as a chemical engineer. After serving the Washburn & Moen Manufacturing Co., Worcester, Mass., and the American Steel & Wire Co., which absorbed the former company, in various capacities for a number of years, in 1912 he joined the staff of the Diamond Rubber Co., Akron, O., which was afterward amalgamated with the B. F. Goodrich Co. Resigning his position as manager of sales for the insulated wire department of the Goodrich company, in 1915 he became connected with the Simplex Wire & Cable Co. as general sales manager, continuing in this capacity up to the time of his death. Mr. Sheppard took a very active part in the work which led to the formation of the Associated Manufacturers of Electrical Supplies. He served as chairman of the preliminary meetings leading up to its formation and was the first president of the association. Mr. Sheppard was a member of the American Institute of Electrical Engineers and many other organizations.

For the Readjustment Period—What?

LXIV.

THRIFT WEEK, just past, has brought out valuable co-operation between various agencies in this country for the promotion of efficiency and economy on the part of workers. The world has yet to discover a substitute for thrift, either for the individual or for the nation. No man gets on in the world who cannot spend less than he makes, and no nation thrives unless its people are able to put by a surplus from the nation's yearly production with which to broaden their opportunities of wealth-creation. Nothing that is permanent and valuable in the world is without its cornerstone of thrift. It is the thrift of the generations of Americans that has built our cities, turned out our machinery and given us our great capacity for producing the myriad articles of comfort and conveniene that help to make this, of all lands, the best fitted for happiness and contentment. It is thrift of individuals which has carved this empire of ours out of a wilderness of prairie, forest and mountain. And it is by thrift only that the nation can hope to sustain and increase its progress. Captains of the electrical industry, whether manufacturers, distributors or central-station managers, will do well to lend their active encouragement to all thrift movements for the benefit of their employes. Most, if not all, of them are already doing so.

C. A. TUPPER, President,
INTERNATIONAL TRADE PRESS, Inc., Chicago

Financial News

Westinghouse Electric Bookings for 1920 Large.

The Westinghouse Electric & Manufacturing Co. is making big strides in booking of orders which will probably enable it to rival the record showing of the year ended March 31, 1919. It is understood that bookings have recently climbed close to $15,000,000 a month, which compares with an annual rate of less than $100,000,000 during the early part of the current fiscal year.

The following table makes a comparison of capital outstanding, sales billed, earnings per share and balance carried to surplus in the last five years:

Year to Mar. 31.	Stock out-standing.	Sales billed.	Earnings per share.	Bal. to surplus.
1919	$74,812,650	$160,379,943	$10.06	$9,822,224
1918	74,812,650	95,735,407	10.29	9,794,883
1917	74,812,650	89,539,422	*15.10	14,049,980
1916	56,643,500	50,269,240	8.52	6,859,929
1915	41,323,788	33,671,485	2.43	302,455

*Calculated on basis of $59,855,500 capital stock, since the $15,000,000 additional common stock was not issued until February, 1917, and therefore proceeds did not increase company's earning power in the 1917 year.

With the exception of slightly over $6,000,000 Westinghouse Machine Co. bonds assumed by Westinghouse Electric company there is no bonded indebtedness ahead of the stock other than the $15,000,000 one-year notes due Feb. 1. These notes refunded at their maturity in February, 1919, because at that time it was clearly sound financial policy to do so.

There is no reason to believe that the notes will not be retired in full next month. Considerably over $2,000,000 is understood to have been already retired by purchase in the open market. The company's cash position was greatly strengthened by the recent payment of $5,250,000 for its British holdings. Government accounts are also being gradually adjusted and paid, so that the company's ability to meet its maturing obligations without embarrassment is unquestioned.

The company's increased business appears even to have exceeded the general increase in demand for all electrical equipment. Turbines and other electrical ship-propulsion machinery, which are being concentrated on at the Essington plant, are especially in demand. Railroad work, particularly electric locomotives, and public utility work, which of necessity lapsed sadly during the war, will also be of great benefit to the company.

Financial Status of Cities Service.

The Cities Service Co. closed the year with earnings showing good gains, December having been the best month from an earning viewpoint since May. Gross earnings for December were $1,757,622, an increase of $144,541 over November, 1919, and $456,913 over August, 1919. Earnings available for reserves, dividends on common stock and surplus for December were $1,154,675, a gain of $107,247 over the preceding month and of $426,702 over those for August, 1919. There has been a steady increase in the monthly earnings of Cities Service Co. since midsummer, and the outlook is that this increase will continue for an indefinite period.

The public utility department is starting the year with the outlook for the best earnings in its history, the management feeling that the public utility division is now making progress on a basis indicating that the handicaps of the war have been met effectively, and are looking forward to renewed progress in this department of activities.

Notice has been filed with the Secretary of State by Landers, Frary & Clark, manufacturer of electric appliances, of an increase in the capitalization from $5,000,000 to $6,000,000, to provide for general business expansion.

Potomac Edison Merger.

Elimination of plants of the Grafton Traction Co. and the Grafton Light & Power Co. of Grafton, West Virginia, from the syndicate formed by the Potomac Edison Co., which plans linking up plants in Maryland and West Virginia, will have no effect on the merger.

James A. McHenry, an official of the Cumberland (Md.) Electric Railway and the Edison Illuminating Co., stated that the properties at Cumberland would be taken over by the syndicate as per agreement which the Maryland Public Service Commission has approved.

The Grafton plants, which had been controlled by John F. McGraw, had been in bankruptcy court, but the creditors looked more favorably on the scheme of the syndicate to take them over than to sell at the bankruptcy sale, and the Federal court concurred. It was ascertained by the backers of the merger that the gas plants embraced in the transaction with the uncertainty of supply were not sufficient security for the financing of such a gigantic proposition.

Union Light Bonds Offered.

A syndicate of bankers, comprising A. B. Leach & Co., Inc., Field, Richards & Co., and the Fifth-Third National Bank of Cincinnati, is offering at 100 and interest in denominations of $100, $500 and $1000, $2,150,000 first mortgage 7% five-year gold bonds of the Union Light, Heat & Power Co. of Covington, Ky. These bonds will be secured by a first mortgage on all the property of the company now owned or hereafter acquired and provides that no more than $5,000,000 of bonds shall be outstanding at any time. The mortgage provides that bonds in addition to the $2,150,000 to be presently outstanding shall not be issued. They will retire at maturity $1,560,900 two-year 6% first mortgage lien gold notes, due Feb. 15, 1920, to purchase and cancel $303,300 5% 50-year gold bonds, due Nov. 1, 1965, now outstanding, and to provide funds for additional extensions and improvements to the property. Payment of interest and principal of these bonds is secured by the Columbia Gas & Electric Co., which showed a net surplus for the year ending Nov. 30, 1919, after paying all fixed charges and taxes, including Federal taxes, of $2,947,561.

Dividends.

A quarterly dividend of $1 a share has been declared on the common stock of the Blackstone Valley Gas & Electric Co., payable March 1 to stock of record Feb. 16.

Dayton Power & Light Co. has declared a quarterly dividend of 1¾% on preferred stock, payable Feb. 2 to stock of record Jan. 20.

The board of directors of the Brooklyn Edison Co. has declared a regular quarterly dividend of $2 per share on the amount of the capital stock outstanding, payable March 1 to stockholders of record Feb. 6.

A quarterly dividend of 1½% has been declared on the capital stock of the Columbia Gas & Electric Co., payable Feb. 15 to stockholders of record Jan. 31.

The Cities Service Co. declared the regular monthly dividends of one-half of 1% on the preferred stock, and one-half of 1% on the common stock, payable in cash, also the regular monthly dividend of 1¼% on the common stock, payable in common stock at par. The regular monthly dividend of one-half of 1% on the preference B shares was also declared. All dividends are payable March 1 to stock of record Feb. 15.

The Inter-City Radio Corp. of Delaware has filed notice with the Secretary of State of an increase in its capital from $25,000 to $125,000, to provide for general business expansion.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid Jan. 20.	Bid Jan. 27.
Adirondack Electric Power of Glens Falls, common	6	16	14
Adirondack Electric Power of Glens Falls, preferred	6	77	78
American Gas & Electric of New York, common	10+extra	125	125
American Gas & Electric of New York, preferred	6	39	39
American Light & Traction of New York, common	..	193	190
American Light & Traction of New York, preferred	6	88	89
American Power & Light of New York, common	4	68	66
American Power & Light of New York, preferred	6	70	72
American Public Utilities of Grand Rapids, common	..	8	8
American Public Utilities of Grand Rapids, preferred	7	20	20
American Telephone & Telegraph of New York	..	98	97¾
American Water Works & Elec. of New York, common	..	2	2
American Water Works & Elec. of New York, particip	7	8	6
American Water Works & Elec. of New York, first preferred	..	50	48
Appalachian Power, common	..	3	3
Appalachian Power, preferred	7	20	20
Cities Service of New York, common	+extra	403	402
Cities Service of New York, preferred	6	73	71½
Commonwealth Edison of Chicago	8	108	107
Comm. Power, Railway & Light of Jackson, common	..	18	18
Comm. Power, Railway & Light of Jackson, preferred	6	43	43
Federal Light & Traction of New York, common	..	6	7
Federal Light & Traction of New York, preferred	..	40	42
Middle West Utilities of Chicago, common	2+extra	20	21
Middle West Utilities of Chicago, preferred	6	42	45
Northern States Power of Chicago, common	..	60	60
Northern States Power of Chicago, preferred	ex.div.7	88	88
Pacific Gas & Electric of San Francisco, common	..	58¼	57
Public Service of Northern Illinois, Chicago, common	7	76	78
Public Service of Northern Illinois, Chicago, preferred	6	88	88
Republic Railway & Light of Youngstown, common	4	11	14
Republic Railway & Light of Youngstown, preferred	6	42	44
Standard Gas & Electric of Chicago, common	..	26	25½
Standard Gas & Electric of Chicago, preferred	6	41¼	40
Tennessee Railway, Light & Power of Chattanooga, common	..	1	1
Tennessee Railway, Light & Power of Chattanooga, preferred	6	6	7
United Light & Railways of Grand Rapids, common	4	28	28
United Light & Railways of Grand Rapids, preferred	6	61	60
Western Power of San Francisco, common	..	21	21
Western Union Telegraph of New York	extra	87	86¼
Industries.			
Electric Storage of Philadelphia, common	4	130½	129
General Electric of Schenectady	8	167½	168
Westinghouse Electric & Mfg. of Pittsburgh, common	7	52⅞	53¼